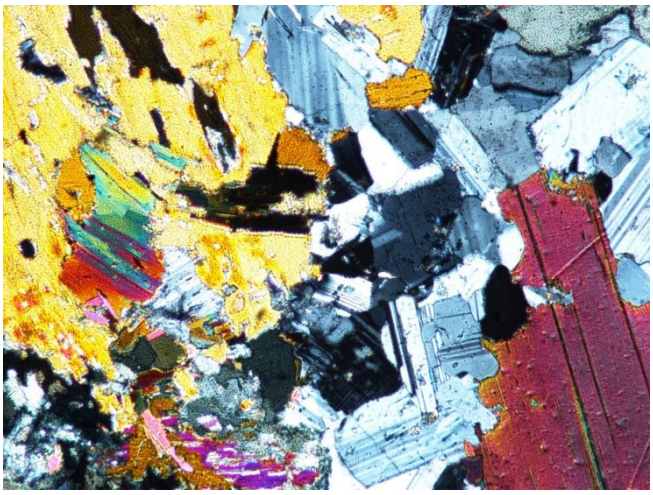

For Liberal Arts and Sciences Laboratory Work

A Guide to Safety

– To ensure the safety of the experiment –

2022–2023

名古屋大学
NAGOYA UNIVERSITY

Contact Flow in the Event of the Occurrences of a Disaster

Fire

Notify the instructor and TA loudly and ask for cooperation

↓ Initial firefight, if possible
※ If you sense danger, evacuate

Press the fire alarm button

Call **the security guard room** at the Liberal Arts and Sciences Main Building
Ext.:3500(from outside line:052-789-3500)
※ At the time of absence
The ILAS office
Ext.:4725(from outside line:052-789-4725)

【When requesting a Fire-Engine. 】

Call a Fire Station(119)
(Ext.:0119)

Notify the Information
(Security Guard Station)
Ext.:4917/110/119
(from outside line:052-789-2111)

Sudden illness, Accident, Incident

Notify the instructor and TA loudly and ask for cooperation

【Report the situation】
【Request an ambulance】
≪**Health Care Room at Liberal Arts and Sciences Main Building**≫
Ext.:3520(from outside line:052-789-3520)
≪**Health Administration Office**≫
Ext.:3970/3969
(from outside line:052-789-3970/3969)

【When requesting an ambulance.】

Call a Fire Station(119)
(Ext.:0119)

Notify the Information
(Security Guard Station)
Ext.:4917/110/119
(from outside line:052-789-2111)

First Aid Treatment
※Ask for instruction in Health Room at Liberal Arts and Sciences Main Building or in Health Administration Office

Report to the ILAS office
Ext.:4725(From outside line:052-789-4725)

Request to send out administrative staff depending on the degree of injury ↓ ↑↓ Consultation about aftercare as necessary

After…

Submit the Accident/Disaster Report

※ Write by the Instructor in charge

How to submit the Accident/Disaster Report (Environment, Health & Safety Office) (Internal page)
https://www.esmc.nagoya-u.ac.jp/limit/jikoinfo/jikoinfo_teisyutu.html

To Environment, Health & Safety Office
(Also, to ILAS)

Student's Affiliation

※Contact the parents, Confirm the situation, as necessary

Humanities	(052)789-4881	Sciences	(052)789-2808
Education	(052)789-2606	Economics	(052)789-2357
Law	(052)789-2317	Informatics	(052)789-4823
Engineering	(052)789-3599	Agricultural Sciences	(052)789-4010
Medicine (Health Sciences)			(052)719-1518
Medicine (Medicine)			(052)744-2430

Nagoya Daini Red Cross Hospital (052)832-1121 Nagoya University Hospital (052)741-2111 Seirei Hospital (052)832-1181

How to Use this Handbook

Among the Liberal Arts and Sciences courses, the Basic Courses in Natural Sciences: "Laboratory in Physics," "Laboratory in Chemistry," "Laboratory in Biology," and "Laboratory in Earth Science" are all practical-style classes focusing on experiments and observations.

Therefore, students are expected to operate equipment and instruments, handle chemicals and biological and mineral samples by themselves, and actively participate in the classes through field observations. Such classes allow students to acquire a great deal of academic knowledge which is not possible in a lecture-style class but also provides a valuable opportunity to interact with faculty members and Teaching Assistants (TAs) through one-on-one instruction. On the other hand, students must always be aware that there are significant risks associated with the class, such as accidents. Of course, these classes are designed for students who have just started the first year of university. As long as students conduct the experiments following the safety precautions, students will be able to enjoy the classes without any worries.

This handbook is roughly composed of two major sections: Common Safety Precautions in all laboratories and Specific Safety Precautions in each laboratory. First, carefully read and understand the common precautions written on pages 1 and after. In this section, basic safety information such as the procedure of first aid and extinguishing a fire, as well as important information on what to do in an accident. Next, carefully read the relevant pages of the class you will attend. These pages contain precautions and instructions on how to handle equipment and other items to ensure safety tasks in each class. Be sure to read and understand the contents of this handbook before starting experiments, and conduct experiments with an awareness of safety. Of course, just by reading this handbook carefully safety of the experiment is not 100% guaranteed. Each student is required to understand the contents of the class well. To better understand the content of the class, reading and understanding the textbook and handouts used in class will be also important. Safety precautions may be included in the textbook, and given verbally or on a whiteboard during class. Please follow them carefully.

Because the contents of this handbook will serve as a basis for the safety education necessary for future advanced experiments and practical training in specialized courses and graduation research. We hope you will use this handbook effectively, enjoy the class safely and spend fulfilled university life.

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1 Common Precautions

1. General Precautions for Laboratory Experiments

No Eating or Drinking

Eating and drinking are strictly prohibited in the laboratory.

Organizing the Experimental Table

Keep the laboratory desk tidy and clean, and only put necessary items for an experiment such as the laboratory equipment, a textbook, a laboratory notebook, writing materials, and calculators.

Where to Place Personal Belongings

Bags, coats, umbrellas, and other personal belongings should be placed on shelves or other designated places. When a locker is available, personal belongings should be stored in it. Do not place luggage on the floor in the lab, as it may obstruct traffic or evacuation, and cause accidents.

Explanations at the Beginning of the Experiments

At the beginning of experiments, the instructor will explain the contents of the experiment as well as the things to be considered as a risk assessment. You should understand the explanations before you start the experiment. Some precautions might be explained during the experiment.

Description of Precautions

Precautions are also described in the textbook. These precautions should be strictly observed when conducting experiments.

2. Waste from Laboratories

As overall, Nagoya University is committed to waste reduction and recycling. Waste at the university is classified as (A) general waste and (B) experimental waste. Each type of waste must be treated and disposed of appropriately. The waste generated by experiments is classified as experimental waste, and it is strictly prohibited to bring other waste and unnecessary items into the laboratory due to the limited number of waste containers in the laboratory. Each of those types of waste is prescribed in the Nagoya University General Waste Collection and Treatment Guidelines and the Nagoya University Waste, etc. Treatment Methods. You need to understand and follow these guidelines and methods for handling of waste, which is one of the basics for future experimental practice at Nagoya University.

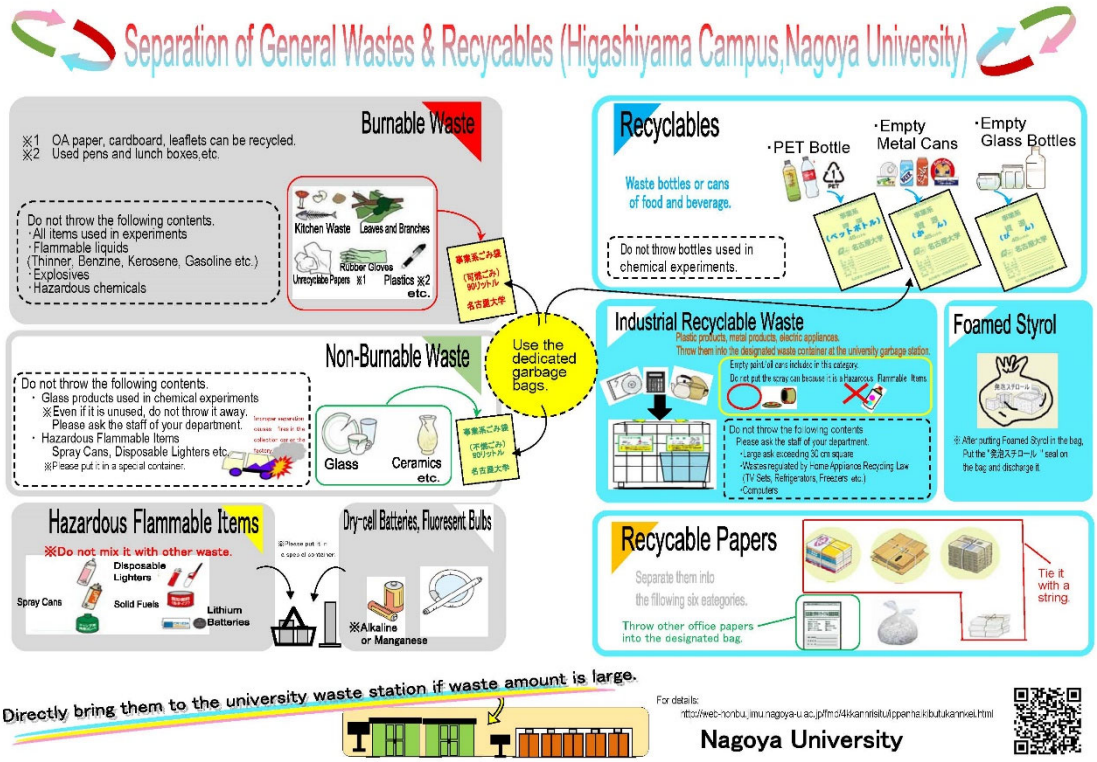
Waste Classification

（A）General waste: Waste which is generated from activities such as studies, etc.
(Including paper, plastics, and other materials which are not used in experiments. Naturally, this means items that are not contaminated by chemicals or experimental samples).

（B）Experimental waste: Waste which is generated from experiments.
(Note that this includes regardless the chemical pollution.)

(A) Disposal of General Waste

Dispose of the waste separately according to the method prescribed in the Nagoya University General Waste Collection and Treatment Guidelines. Be careful to surely separate these containers from the experimental waste containers provided in the laboratory. Only limited types of general waste containers are provided in the laboratories. The other types of waste should be disposed of in the designated containers on campus.



(refer to the link below)

Nagoya University Environment, Health & Safety Office Website
Separation of General Waste & Recyclables (Higashiyama Campus, Nagoya University) (Internal Link)
http://web-honbu.jimu.nagoya-u.ac.jp/fmd/05naibu/01document/haiki_naibu/ippanngomitoubunnbetugaido3.pdf

(B) Disposal of Experimental Waste

The presence or absence of pollution or contamination of chemicals etc. is not a criterion for classification as general waste or experimental waste. When disposing of damaged laboratory equipment, it should be treated as experimental waste even if it is unused. For each type of chemical waste, waste container, glass waste, metal waste, paper, plastic, etc., subdivide the waste into the following categories according to the type of adherent (contained) chemicals and experimental samples used: those containing cyanide, heavy metals (lead, copper, etc.), halogenated organic solvents, infectious biological samples, etc., and dispose of them in the designated containers. The primary and secondary washing solutions of instruments that have been handled with chemicals should also be treated as experimental waste. Dispose of these in accordance with the Nagoya University Waste, etc., Treatment Methods. Students should follow the experiment text, laboratory notices, etc., wash the equipment when necessary, and dispose of the waste in special containers in the laboratory. Cleaning solutions for laboratory equipment should also be disposed of in the designated waste containers until the second time. Depending on the contents of the experiments, the necessary waste containers are provided in the laboratory. The containers should not be filled above 80% of their capacity. If you need to change the container, ask an instructor.

(refer to the link below)

Nagoya University Environment, Health & Safety Office Website
Laboratory waste treatment (Internal Link)

https://www.esmc.nagoya-u.ac.jp/limit/eng/details.html#Laboratory%20waste%20treatment

3. Handling of Electrical Equipment and Devices

Handling of Electrical Equipment and Devices in the Laboratory

Grounding of Electrical Equipment

Since the low-voltage sides of the power distribution equipment and electrical devices used in the experiment are not all grounded (earthed), you must be careful to avoid electric shock. Avoid wiring using an overloaded power strip, and the rated current value of the connected electrical equipment (or the total current value if there are multiple devices) should not exceed the allowable current value of the table-top, etc.

Electrical Hazards and Fires Caused by Electrical Leak

When we handle some electrical equipment, we should pay particular attention to avoid electrical shock and fire caused by electrical leak. The details of this are mentioned later.

Responding to the Failure of Electrical Equipment

Power Disconnection

If the power supply disconnects due to a tripped breaker or a fuse blowing, do not try to repair or restore the power supply by yourself. The power should be turned on again after receiving inspection as it were and permission from the person in charge.

Malfunction of Equipment

If any electrical equipment is not working properly, notify the person in charge of the experimental theme before turning off the power switch. After the person in charge has inspected the cause of the malfunction and repaired the equipment, and after receiving permission, use the equipment again.

Preventing Electrical Hazards

Basic Knowledge of Electric Shock

Electrical shock hazard can lead to serious, even life-threatening, accidents, so the greatest care must be taken when handling electrical equipment in experiments. It could be considered the degree of damage caused by an electric shock is determined by the magnitude of the current flowing through the human organs . The effects on the human body of electric shock from 60 Hz alternating current are classified into the following stages.

1 mA	No pain, just feel
5 mA	Considerable pain
10mA	Unbearable pain
20mA	Muscle contraction is so severe, unable to break free from the circuit on own
50mA	It is quite dangerous
100mA	Fatal consequences

The resistance in the human body is low, estimated to be about 500Ω at most. If there were no skin contact resistance, the current flowing through the human body would be as much as 200 mA in the event of a 100 V electric shock, which would be fatal. Therefore, the effect of electric shock on the human body depends on the resistance between the high-voltage side and the skin in contact, and the resistance between the human body and the ground potential.

To prevent electrical shock hazard, it is important not only to take care not to touch exposed metal parts that are energized, but also to conduct experiments by eliminating causes of low resistance in contact areas and current paths, such as wet hands or skin, wet floor, or body parts touching the ground wire.

Precautions to Prevent Electrical Hazards

Water Spillage and Electric Shock

- Do not handle electrical equipment with wet hands, feet, or at the time your feet are wet or the floor is wet.
- When using water or ice in some experimental themes, special care must be taken.

Sufficient Understanding of Wiring

- Fully understand the electric devices and wiring used to ensure that you can take the proper actions promptly in the event of an accident.

Exposed Metal Parts

- Be careful not to touch exposed metal parts of electrical circuits such as power supplies, wiring, and terminals.

Operation of Electrical Equipment

- Do not operate electrical equipment with tools, writing utensils, etc. in your hands.

Disconnection of Power Supply at the Time of Wiring

- Always turn off the power switch and unplug from the power supply box or wall outlet before wiring, rewiring, or un-wiring an electrical circuit.

Capacitor Discharge

- Since capacitors may be used in the electrical circuits inside electrical equipment, allow a little after switching off to discharge the capacitors when changing or disconnecting the wiring.

Precaution Against Electrical Fires and Burns Accidents

Electrical Fires and Burns Accident in Laboratories

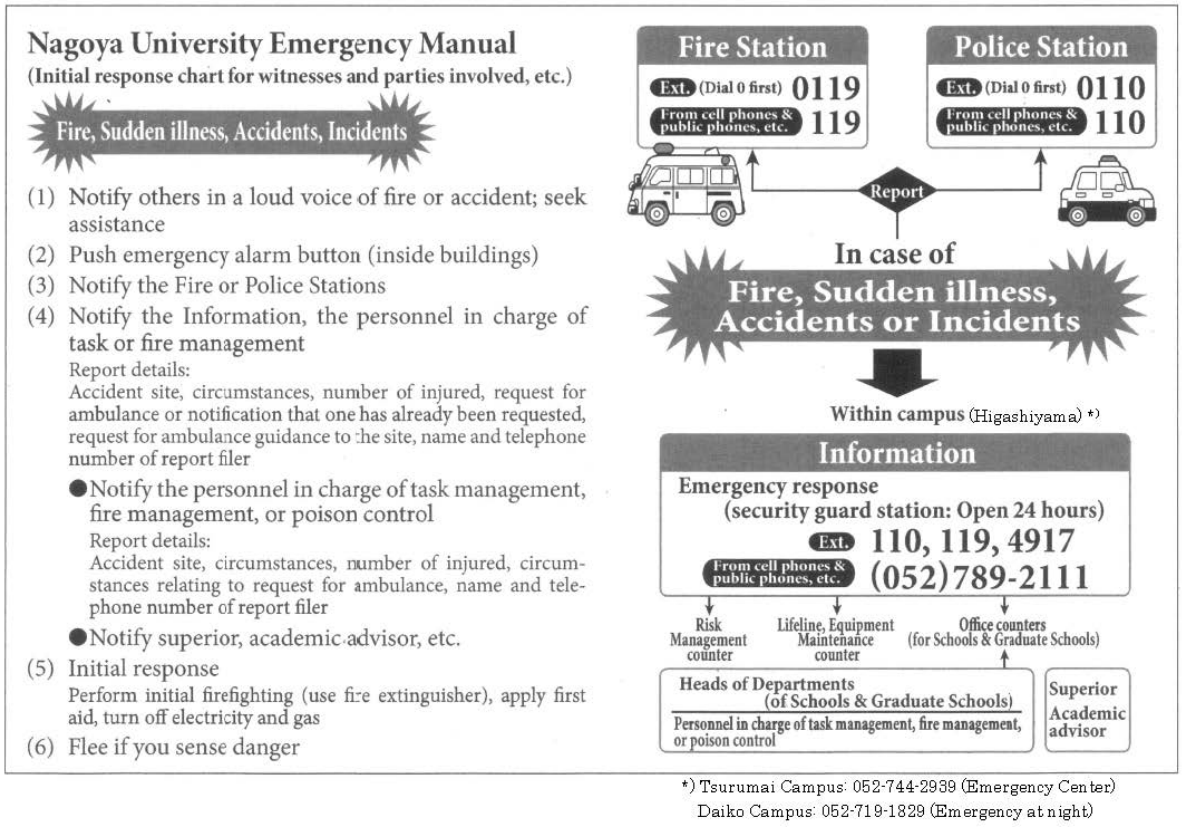
Electrical leakage and poor connection in electrical circuits possibly become the causes of electrical fires and burns. The following points should be noted to prevent such accidents.

- Except in cases of special instructions, such as computer-related equipment that is not switched off, unplug it from the power supply box or wall socket after the experiment and do not leave it plugged in.
- **Tighten the screws at the terminal connections of electrical circuits sufficiently so as not to cause a poor connection.** Particularly, sufficient care should be required with experimental equipment that will be energized for a long period of time.
- Pay attention not to burn yourself by touching high-heat parts.

How to Deal with in Case of Getting a Burn

In case of getting a burn, firstly cool the burn by running tap water. It would be better if slightly above the burn, not directly, could be poured running water. If the burn has gotten with clothes on, cool the burn over clothes with running water. Use the tap water from the sinks provided in each laboratory. At the same time, ask someone nearby to contact the faculty members and receive instructions.

4. Nagoya University Emergency Manual (Initial Response Chart for Witnesses and Parties involved, etc.)



Nagoya University Emergency Manual
(Initial response chart for witnesses and parties involved, etc.)

Fire, Sudden illness, Accidents, Incidents

(1) Notify others in a loud voice of fire or accident; seek assistance
(2) Push emergency alarm button (inside buildings)
(3) Notify the Fire or Police Stations
(4) Notify the Information, the personnel in charge of task or fire management
Report details:
Accident site, circumstances, number of injured, request for ambulance or notification that one has already been requested, request for ambulance guidance to the site, name and telephone number of report filer
- Notify the personnel in charge of task management, fire management, or poison control
Report details:
Accident site, circumstances, number of injured, circumstances relating to request for ambulance, name and telephone number of report filer
- Notify superior, academic advisor, etc.

(5) Initial response
Perform initial firefighting (use fire extinguisher), apply first aid, turn off electricity and gas
(6) Flee if you sense danger

*) Tsurumai Campus: 052-744-2939 (Emergency Center)
Daiko Campus: 052-719-1829 (Emergency at night)

(refer to the link below)

Nagoya University Environment, Health & Safety Office Website
Nagoya University Emergency Manual (Initial response chart for witness and parties involved, etc.)
https://www.esmc.nagoya-u.ac.jp/limit/eng/71_Emergency_Preparedness_and_Response/NagoyaUnivEmergencyManual_EN.pdf

5. Procedures in the Event of a Disaster

※ For the contact information and flow, please refer to the front back page of this handbook.

Treatment

In case of injuries that require medical attention, refer to the following information and take appropriate measures.

About the Hospital that can Accommodate Patients

The nearest major medical facilities are listed below. In case of emergency, call in advance and confirm whether or not the patient can be treated, especially at night before going.

【general hospitals】

1) Nagoya Daini Red Cross Hospital TEL (052) 832-1121
2) Nagoya University Hospital TEL (052) 741-2111 (Ext.81-2840)
3) Seirei Hospital TEL (052) 832-1181

【Surgery, Orthopedics】

1) Maeda Orthopedic Clinic TEL (052) 861-2251
2) Hachiya Orthopedic Hospital TEL (052) 751-8188
3) Wakayama Orthopedic Hospital TEL (052) 761-1200

About Ambulances

1) Approximate criteria for requesting
   - ◇ When a stretcher is required
   - ◇ When there are no other means of patient transportation, such as at night, etc.
2) Tips for making a request
   Explain the symptoms on an emergency call(119). Medical equipment that can provide first aid during transportation will be loaded on ambulance. (For extension call, "0119").
3) Guidance of the ambulance
   The ambulance will arrive at the information (Security Guard Station). The person requests it should contact the information (Security Guard Station)*1 and the security guard room at the Liberal Arts and Sciences Main Building*2 and guide the ambulance to the place. If you cannot leave this place, explain the situation to the security guard room and ask them to guide it.

   *1 Information (Security Guard Station) TEL 052-789-2111 (ext.4917)

   *2 security guard room at the Liberal Arts and Sciences Main Building TEL 052-789-3500 (ext.3500)

Utilization of the Health Care Room and the Health Administration Office

During the daytime, a nurse is stationed in the Health Care Room (ext. 3520 (outside line 052-789-3520)) at the Liberal Arts and Sciences Main Building, and a doctor and nurse are stationed in the Health Administration Office (ext. 3970, 3969 (outside line 052-789-3970, 3969)). If a person needs immediate treatment or is unable to move, contact them directly for consultation.

Payment of Medical Expenses, etc.

1) If you do not have your health insurance card with you, inform the hospital of this.
2) If you do not have enough money with you, ask the hospital to arrange for later payment.

Others

1) If no one is available to deal with a disaster at night, call the Security Guard Room at Liberal Arts and Sciences Main Building (ext. 3500 (outside line: 052-789-3500)) and ask for assistance.
2) If there are only students at the time of a disaster, contact a faculty member.

In Case of Fire

Initial Fire Fighting

1) Shout “Fire!” and ask for help from others nearby.
2) Shut off the main gas valve, turn off the electrical devices, etc.
3) Remove any combustibles around.
4) Check the fire and extinguish it with a fire extinguisher.
5) Press the fire alarm button, and report it.
6) If flames reach the ceiling or smoke is too thick to control, evacuate immediately.

Fire Alarm

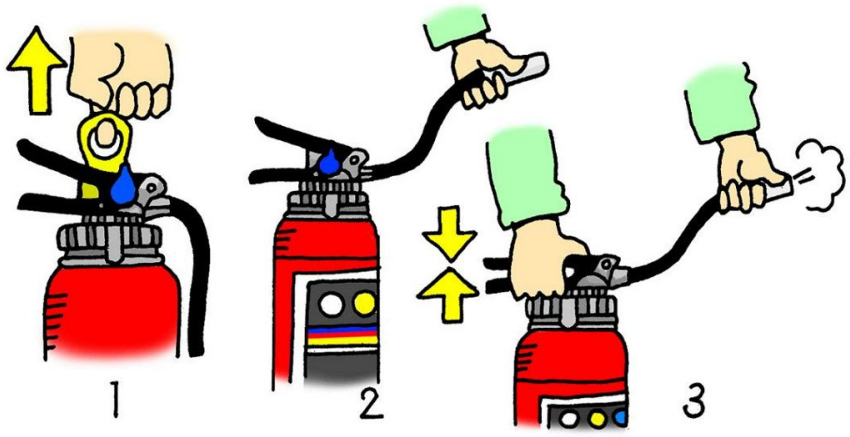
1) Fire alarms are installed on the walls of the corridors on each floor.
2) The fire alarms are connected to the security guard room at the Liberal Arts and Sciences Main Building.
3) The button on the fire alarm also serves as the activation button for the fire hydrant.
4) The fire alarm is not connected to the fire department, so it is necessary to call 119 to request a fire engine or ambulance. (0119 on an extension phone).

Fire Hydrant

1) When used in an emergency, keep in mind that the activation button of the fire hydrant doubles as a fire alarm button and that high water pressure makes it difficult for a single person to secure the end of the hose (it can be swung around).

Fire Extinguisher

1) Fire extinguishers are located in the corridors of each building and in the laboratories.
2) Check the installation locations and learn how to use them so that they can be used immediately in the event of a fire.
   (1) Remove the safety pin.
   (2) Disconnect the hose with the dominant hand and point it toward the fire.
   (3) Squeeze the lever tightly.
   (4) Extinguish the fire from the periphery of the burning part toward the center.



Source: the website of Nagoya University Environment, Health & Safety Office

3) There are two types of fire extinguishers in the laboratory: powder extinguishers and carbon dioxide extinguishers. Carbon dioxide extinguishers are partially painted green. Either type of extinguisher can be used for most fires, but if metallic sodium or metallic magnesium starts to burn in a chemistry laboratory, a powder extinguisher must be used. When extinguishing fires near precision equipment such as computers, the use of a carbon dioxide extinguisher is desirable to prevent damage to the equipment. When using a carbon dioxide extinguisher to extinguish a fire in a wooden product such as a laboratory table or furniture, be aware that the fire may reignite after a while even if the fire is extinguished once.

powder fire extinguisher

carbon dioxide fire extinguisher

Prepare for Natural Disasters (Earthquakes and Typhoons)

1) Regularly check evacuation routes.
2) Prevent shelves and other items from tipping over.
3) When evacuating, turn off the power to prevent secondary disasters.

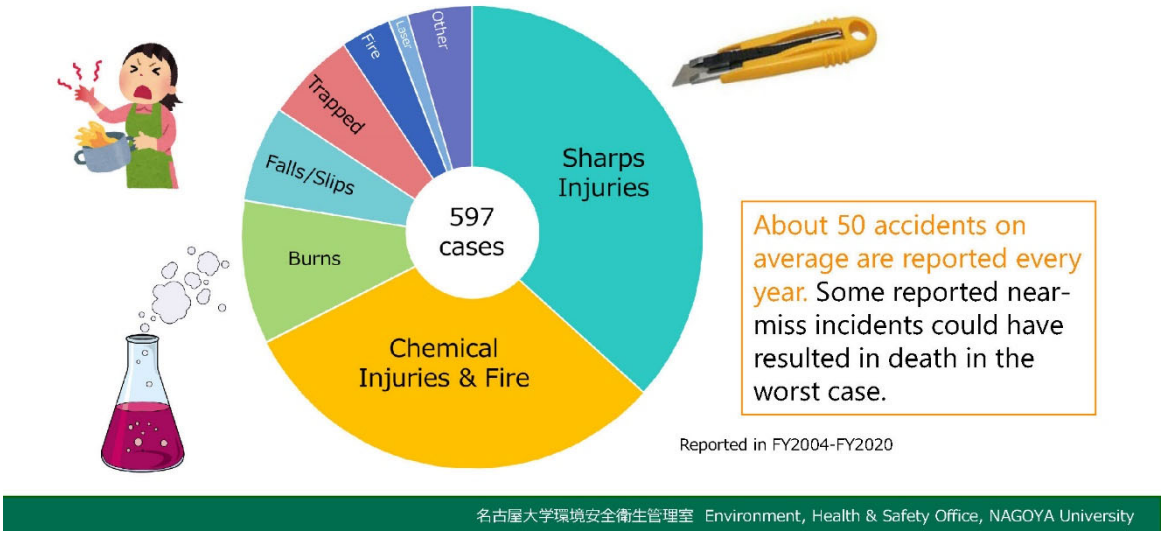
6. How to Prevent Disasters Caused by Experiments -Actual Examples of Disasters in Experiments

Experiments in Laboratory in physics, chemistry, biology, and earth sciences will be the first experiments that students experience at the university. Therefore, extreme care is taken with regard to the content of each experiment and the experimental equipment and chemicals used to prevent accidents from occurring, and even if an accident does occur, to minimize the risk of injury as possible is also paid attention. However, no matter what measures are taken to prevent accidents, there are no "absolutes," and a certain number of accidents have occurred in experimental classes of Liberal Arts and Sciences. In order to prevent such accidents, it is important to know what kind of accidents and disasters actually occur, so that it helps to be able to minimize them.

Disasters Due to the Experiments at Nagoya University

The statistics and examples of recent experimental accidents at Nagoya University are described below, so they could be a reference for preventing accidents in experiments.

Laboratory Accidents at Nagoya University



Since these accidents mainly occurred in chemical and biological experiments, special attention should be paid to them. The following is a list of specific examples of accidents, their causes, and countermeasures.

Accidents Involving Glass

1) When a person tried to pass a glass tube through a hole in a rubber tube or a rubber stopper, the glass tube was broken, causing lacerations on the hand because the hand holding the glass tube and the hand holding the rubber capillary or the rubber stopper were far apart.
2) A person shook a mixture of ether and water in a separation funnel hard, which caused the glass to break under pressure, resulting in a cut on the thumb of the right hand. After first aid treatment at the Health Service Center, a person received three stitches at the Nagoya Diani Red Cross Hospital.
3) A person tried to grab a broken measuring flask that had been knocked over by catching in the hand, and a person cut the left middle finger in the shape of a hook with the broken part. 3 stitches and going to the hospital for treatment for about one week were needed.
4) When a person tried to open an old reagent (pyruvic acid) in an ampule with a hot bulb, the internal pressure increases due to heating, causing an injury by bursting the ampule and sticking the glass into one's hand.
5) When a person put one's hand in the sink of the experimental table, a finger was cut with a piece of glass that had fallen into the water.

Countermeasure

These accidents could have been avoided by understanding the strength of glass, using common sense in handling such as not applying more force than necessary, inspecting glassware used in experiments, wearing protective gloves when handling glass, and organizing the laboratory table.

Accident Involving Electricity

1) As a screw at the end of the power cord came off, short-circuited with another wire, and burned the coating, the switchboard was turned off and the fire was extinguished. There was no human casualty.
2) While changing the wiring of the experimental circuit, an excessive current flowed to the cord of a table tap on the table due to a wiring error, which generated heat, melted the sheath, and caught fire. The switch was turned off and the fire was extinguished with a fire extinguisher.

Countermeasure

These accidents could have been prevented by having sufficient knowledge of the experimental equipment and electrical circuits used in advance, and by inspecting the experimental equipment and circuit wiring to be used.

Others

1) (Gas leak) The main gas valve was damaged, and there was a considerable amount of gas leakage so that the smell of gas could be recognized even in the corridor.
2) (Fire accident) While drying sand samples in a heat-resistant acrylic container at 100° C in a dryer, a part of the dryer became locally overheated, causing the container to melt and fall on the heating line, igniting a fire that was extinguished with a fire extinguisher.
3) A student got burned by knocking over a hot oil bath in an experiment.

Countermeasure

It is necessary to understand that high-temperature heat sources and fire sources can cause burns and fires and to manage and handle them with care. Accidents can be prevented by inspecting equipment, checking heat-resistant temperatures, and taking measures such as cooling hot objects to a safe temperature before handling them. In addition, in preparation for the occurrence of a fire that can be extinguished with a fire extinguisher, it is necessary to inform everyone about the location and use of fire extinguishers on a daily basis.

Examples of University-wide Education Courses

CASE 1

During a chemistry experiment, a chemical (unknown type) unintentionally adhered to a person’ s arm. The person was treated at a hospital for blisters, which required the person to attend a hospital for two days.

CASE 2

During a chemistry experiment, while attaching a safety pipette filler to a volumetric pipette, the volumetric pipette broke off and pierced the left hand, causing a cut.

CASE 3

During a chemistry experiment, when removing a rubber dropper from a glass pipette, a lateral force was applied and the top of the pipette broke off, pierced his right hand, and injured a cut.

CASE 4

During a chemical experiment, a chemical adhered to the hand. The person unconsciously rubbed his or her right eye with his or her hand. The eye was rinsed with water, but his or her eye became slightly swollen and he or she felt that the vision was limited. After visiting an ophthalmologist, the eye was cured later.

7. First Aid and Life-saving Treatment

First Aid and Life-saving Procedures

1. Talk to the victim while tapping on the shoulder.

2. If the victim is unresponsive or it is difficult to judge his or her conditions, shout for help and ask the people nearby to dial 1-1-9 and bring the AED.

3. See if the victim is breathing.

Check the chest and stomach for normal breathing. [Within 10 SECONDS]

4. If the victim is no breathing or it is difficult to judge his or her conditions, start cardiac compression. [30 TIMES]

30 compressions

Where? Middle of the chest

5. If you have trained skills for rescue breaths and no hesitation to perform them, give the breaths 2 times after chest compressions.

2 breaths

- Give 2 breaths. [About 1 SECOND at a time]
- See the chest is rising.

- **If you haven't practiced giving rescue breaths,**
- **If you don't have a mouthpiece for rescue breaths,**
- **If the victim has blood or vomit in their mouth...**

▼

Continue ONLY compressions.

* You can't, or may well not, be infected without a mouthpiece. However, it is recommended.

Give 30 compressions and 2 breaths. Repeat.

6. When you've got AED at hand...

Turn it ON.

Some devices can be automatically turned ON with their lid opened.

(refer to the link below)

Tokyo Fire Department Website

First Aid with AED

What to do next if you find someone lying on the ground

https://www.tfd.metro.tokyo.lg.jp/eng/firstaid/treatment.html

7. Place the pads on the chest.

The pictures on the pads show where they should go.
See that the chest is NOT wet. (If wet, wipe with a towel.)

* If you find smaller pads, use them for chilren at the age of up to 6 or so.

8. AED tells you to give electric shocks.

Stay away from the vicctim while AED is at work.

9. Press the shock button.

See that the victim is NOT touched by anyone.
Then,press the flashing shock button.

Shock button

Press the button and follow the message.

Continue the CPR process until an ambulance unit arrives, or the victim shows movement including normal breathing.

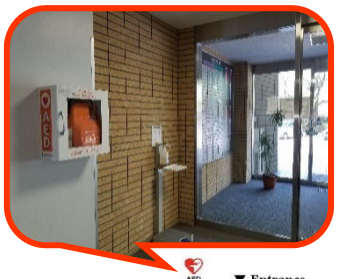
CPR

Give 30 compressions and 2 breaths.

COMPRESSION	where?	Lower part of breastbone (i.e.,middle of the chest)
	How?	With both hands (Children: with both hands or one hand Babies: with two fingers)
	Depth	About 5 cm (1/3 of the chest depth for children and babies)
	Speed	100-120 times/min
BREATHING	How much?	Until the chest rises.
	How long?	About 1 second
	How many?	2 times

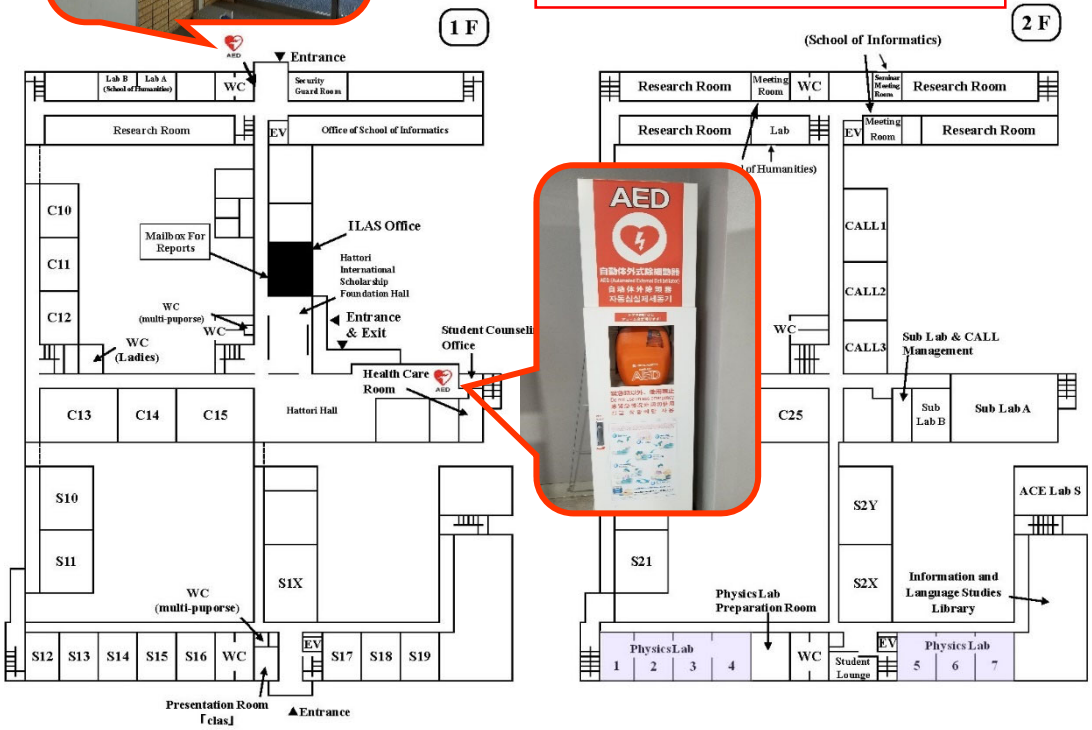
※ locations of AEDs in the Liberal Arts and Sciences Main Building are shown on the next page.

Location of AEDs



If you open the door,
a loud alarm sounds.

Do not open unless emergency!



First-aid (Treatment)

How to Stop Bleeding

Normal bleeding will stop naturally if the wound is kept under pressure.
For massive bleeding, call an ambulance.
Avoid direct contact with the wounded person's blood to prevent infection.
A plastic bag can be used as a glove.

Direct Pressure Method to Stop Bleeding

Press a cloth directly to the wound. Use a clean, thickly folded cloth.
Choose a cloth that can sufficiently cover the wound.

Burn

1) In case of relatively minor burns
① Immediately cool with running water for at least 15 minutes, then apply clean gauze.
② Do not apply any medicine, and be careful not to break the blisters.
③ If the burn is covered with clothing, cool it with running water over the clothing. If the clothing is sticking to the skin, do not forcibly remove it and seek medical attention.
2) In case of severe burns
① In case of extensive burns, wrap the body with a clean sheet, etc. and take the person to a hospital immediately.
② Burns may occur in the airway when hot air due to a fire or gas explosion is inhaled. If nose hairs burn, or if the inside of the nose or throat tingles, seek medical attention.

Chemical Accident

※ If a chemical gets on the body, flush the body with tap water or shower for at least 20 minutes. Do not rub with a brush.
※ If a chemical gets into the eye, keep the eye crackling and moving up, down, left, and right for at least 15 minutes in a washbowl with running clean water. If alkaline chemicals get into the eye, it is necessary to wash thoroughly, so wash the eye for about 30 minutes. After that, see an ophthalmologist.
※ Also refer to the "Laboratory in Chemistry " section of this manual.

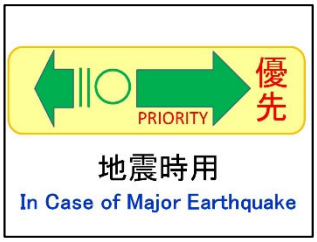
Fractures, Dislocations, Sprains

1) A fracture is suspected when there is severe pain or deformity at the injured area. In this case, fix the injured part with a splint so as not to pressure on it, and go to a hospital for examination.
2) Dislocations should also be fixed with a splint or triangular bandage and promptly taken to an orthopedic surgeon.
3) When a strong force is applied to a joint, a sprain occurs the surrounding tissues (ligaments) are torn or make hyperextension, causing pain and swelling. The affected area should be cooled and kept at rest. If the swelling and pain are severe, see an orthopedic surgeon.
4) In case of Achilles tendon ruptures, should fix the part with a splint, and take a person to a hospital.

8. In the Event of a Major Earthquake, etc.

Emergency Exits for the Laboratory

The recognition of emergency exits should be always required. When instructed to evacuate, follow the guidance of instructors and TAs and evacuate the building in good order without panicking. Follow the evacuation signs (arrows) in the corridors. Leave your belongings in the laboratory when evacuating. Avoid a private conversation. If someone is injured, help him or her out of the building.



Earthquake Early-warning Issued

When an earthquake early-warning is issued, stop the experiment immediately and return the chemicals and equipment in use to the designated chemical cabinet (where they were originally placed) without panic. Turn off the water supply and unplug the electrical outlets. After that, follow the instructions of the instructor and evacuate calmly.

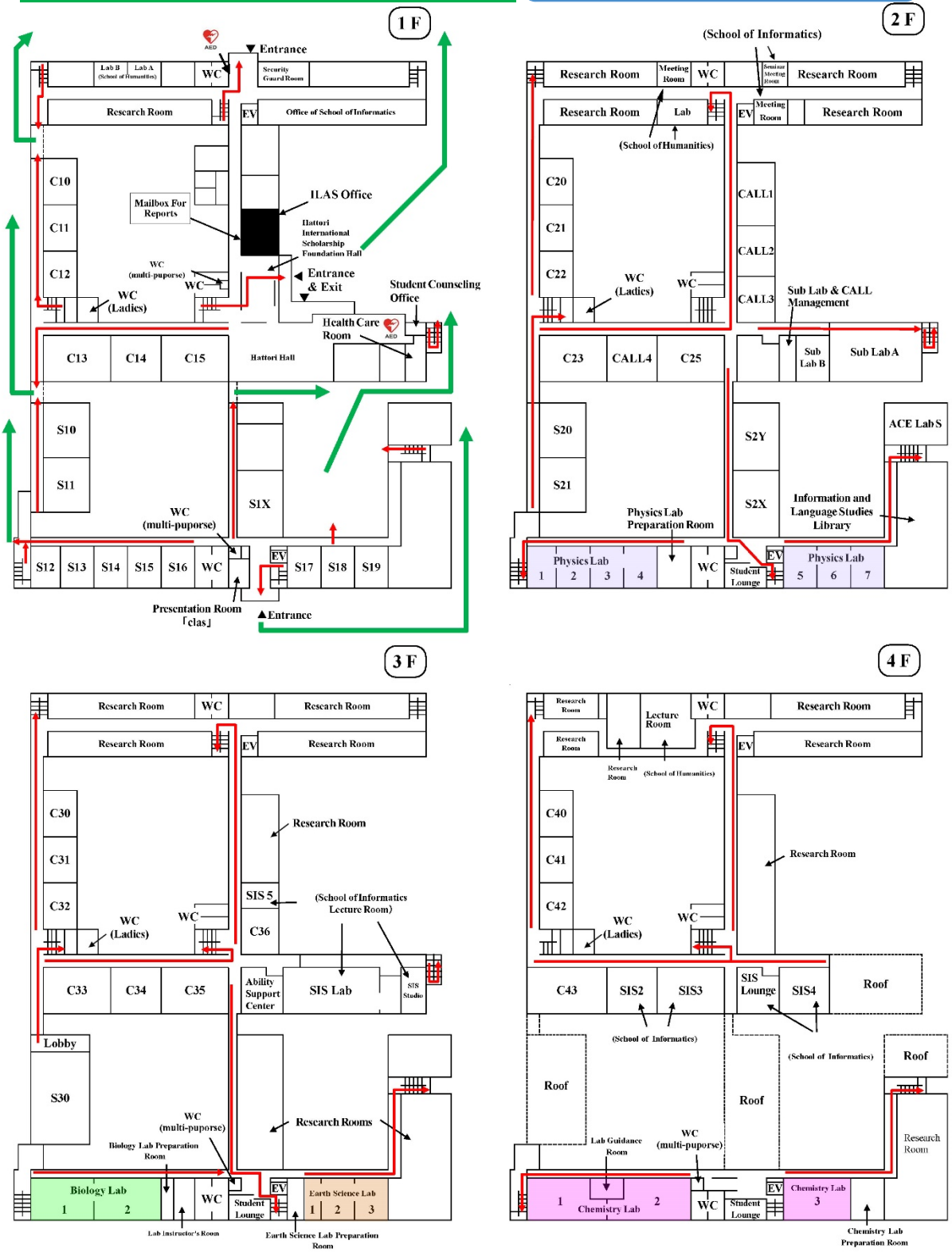
If an Earthquake Occurs During the Experiment

If you feel a strong earthquake, do not panic and go outside the laboratory. If it is not possible to go outside the room, move as far away as possible from the cabinets for chemicals and equipment, and wait in a safe place where objects will not fall until the shaking stop. Since chemicals and other harmful materials might be placed on the tables in the chemistry laboratory, do not hide under the table even if there is a space. The chemicals that fall from the tables may be scattered by the shaking of an earthquake.

Evacuation Route Map of Liberal Arts and Sciences Main Building (for Earthquakes)

Temporary Evacuation Area:
the playing field next to Central Library

Please help to evacuate those who needs support.



2 Laboratory in Physics

Aims and Safety Precautions for Physics Experiments

Laboratory in Physics is one of the physics subjects for first-year science students. Particular emphasis is placed on "hands-on" experience of various experiments by conducting experiments on one's own.

None of the experimental topics in the class are particularly hazardous, as long as the experiments are conducted carefully. However, as with experiments on any subject, it is not always safe to do anything without prior knowledge. Each experiment has the possibility of accidents, even if the probability is very small. It is extremely important to understand the content of the experiment well, to anticipate possible dangers, and to conduct the experiment with a moderate sense of urgency in order to prevent accidents.

The following is a list of accidents and disasters that can be expected when conducting physics experiments, as well as precautions to prevent them. Please read the contents carefully, understand them, observe the precautions, and try to prevent accidents from occurring. In the event of an accident, contact an instructor immediately for instructions.

1. Introduction

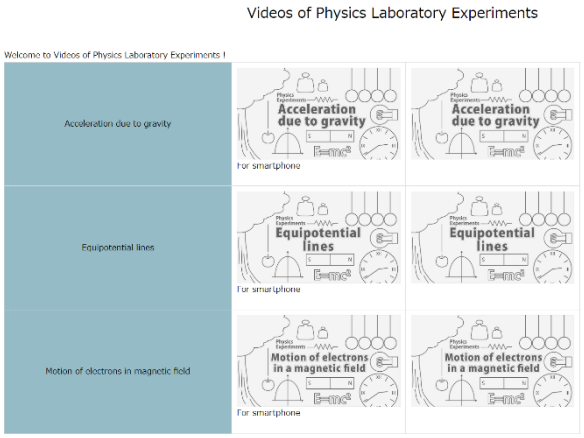
Before Starting the Experiment

Clothes for Experiments

No specific lab coats are specified for physics experiments. Each student must take care to dress appropriately for the experiment and be careful not to cause accidents. For example, avoid excessively revealing clothing even in summer, and remove overcoats and thermal jackets in winter. In addition, metal jewelry should be removed to prevent electric shock.

Preliminary Study for the Experiment

Students should have a good understanding of the contents of the experiment, the experimental equipment used, and the possibility of accidents occurring, using the experimental text and video materials so that you will be able to respond quickly and appropriately in the event of an accident.



Video materials http://elearn.ilas.nagoya-u.ac.jp/lms/pex_e/

Preparation Before Starting the Experiment

Before starting the experiment, it is most important to read the experimental guidelines carefully, compare them with the experimental apparatus, and familiarize yourself with the experiment and its operation in order to prevent accidents during experiments. However, do not wire the experimental apparatus, turn on the power, or operate the equipment until the instructor or TA in charge has explained them.

Precautions during an Experiment

Arrangement of Experimental Equipment

When conducting experiments, the experimental desk should be organized, the experimental equipment arranged, and the electrical circuits wired, which are to make it as easy as possible to operate the experiment. This is also necessary to ensure the safety of the experiment.

Co-experimenter

Experiments are usually conducted by two persons. You must experiment with attention not only to yourself but also to your co-experimenter.

Other Experimenters

Only the person experimenting knows how the experiment is progressing in a particular experimental set. Therefore, carelessly approaching other experimental desks or talking to the experimenter in the middle of an experiment may cause accidents.

Precautions at the End of the Experiment

Experiment Completion Procedure

After the measurements and observations are completed, the experiment should be terminated according to the indicated procedure.
The procedure varies with each experimental topic. For example, some power supplies may or may not be turned off, and some electrical equipment and circuits may or may not be unwired.

Computer Termination

The computer must always be terminated according to the indicated procedure. Must be careful if failure to exit according to the correct procedure or to turn off the power can destroy the system.

Handling of Power Supply Boxes and Wall Outlets

Except for the equipment that is instructed not to be turned off, all power supply boxes and wall outlets other than those used for the computer should be unplugged at the end of the experiment. However, the power supply box should not be switched off.

Disposal of Experimental Waste

Dispose of all used and unnecessary items and replaced defective parts separately in designated garbage boxes, etc.

① Combustibles such as paper, cloth, etc.
② Incombustibles such as lead wires, wires, fuses, glass pieces, etc.
③ Aluminum foil
④ Batteries

2. Handling of Electrical Facilities and Equipment

Electricity Distribution and Equipment

In physics laboratories, 100 V AC voltage is usually supplied from the wiring duct in the ceiling to the power supply box on each experimental desk. In some experiments, the power is supplied to the power boxes from wall outlets. Students must not touch the electricity distribution equipment upstream from the power supply boxes and wall outlets.

High Voltage for Electrical Equipment

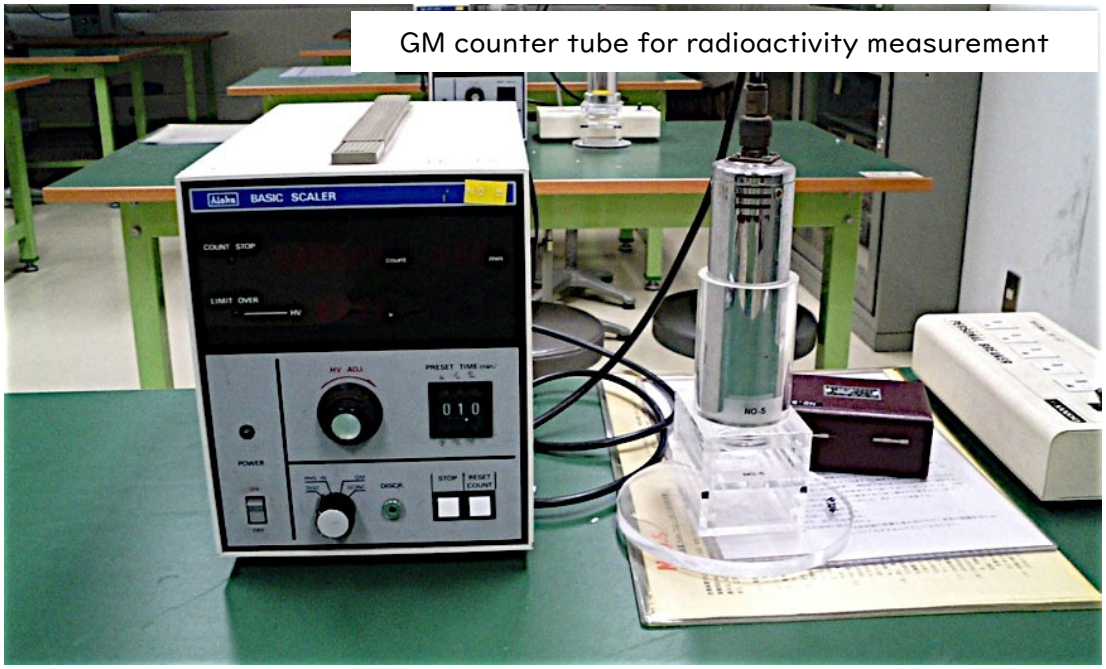
Some of the electrical equipment used in the experiment generates high voltages inside. In these devices, be careful never to touch the high-voltage parts. Even if the high-voltage parts are not exposed, be careful not to leak current into the equipment.

Specific charge measurement equipment _____ 100 ~ 300V

Geiger-Mueller (GM) counter for measurement of radioactivity 1100V

For the handling of general electrical facilities and equipment, refer to page 5, "3. Handling of electrical facilities and equipment".

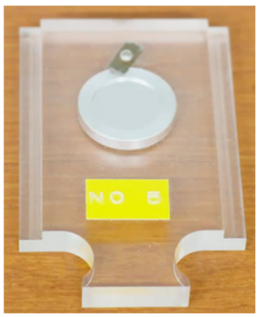
GM counter tube for radioactivity measurement



3. Handling of Radioactive Materials and Radiation

Radiation Sources Used in Experiments

Radiation Source to be Used



In the experimental theme "Measurement of radiation, "the radioactive isotopes strontium-90 (^{90}Sr, a half-life of 28.8 years) and yttrium-90, ^{90}Y, a half-life of 64.1 hours) are used as radiation sources. They are sealed source and radioactive materials in an aluminum dish container are capped on the top by an aluminum thin film of approximately 0.015 mm (15 μm).

Radioactivity Intensity of the Radiation Sources

The radioactivity intensity of the radiation sources is approximately 1.5 kBq (0.04 μCi) and approximately 3.7 kBq (0.1 μCi), respectively. Beta rays (electrons) of the maximum energy of 0.546 MeV are emitted from ^{90}Sr and beta rays of the maximum energy of 2.28 MeV are emitted from ^{90}Y.

Along with the beta rays, gamma rays of 1.76 MeV at the intensity of 0.01% are also emitted from ^{90}Y. In addition, X-rays are generated as secondary radiation as a result of bremsstrahlung when beta rays collide with aluminum, etc.

Handling of Radiation Sources in Experiments

Prevention of Radiation Exposure and Contamination

Care must be needed to minimize radiation exposure to the human body as much as possible and to ensure that contamination by radioactive materials never occurs.

Handling of Sealed Radiation Sources

As sealed radiation sources are used in the experiments, no contamination would occur unless the seal is broken to leak the radioactive materials externally. Nevertheless, since the aluminum film used for the seal is as thin as approximately 15 μm, radiation sources must be handled with the greatest possible care not to break the aluminum film. **Do not touch the film on the top of the source container, poke it with tweezers or writing utensils, drop the source or otherwise impact it.**

Abnormality Notification and Instructions

If you suspect that the aluminum coating has been damaged or contaminated by radioactive materials, contact an instructor, or other staffs immediately and receive instructions.
Do not take measures on your own.

Minimizing Radiation Exposure

Since the radioactivity of the radiation sources used in the experiments is weak and most of the radiation emitted is beta rays, and gamma rays and secondary X-rays are at the level of natural counts, no special shielding is required. However, care should be taken not to keep the radiation sources in close contact with the body for long periods.

Minimization of the Time of Use

Take care that the radiation source is used only for short periods. Do not leave the radiation source unattended on the experimental table. After bringing out a radiation source, immediately attach it to the measurement table and return it to the designated place immediately after the measurement is completed.

Stronger Radioactivity

While in the handling of radiation sources of the level of radiation intensity used in this experiment, no precautions other than those mentioned above are necessary, the followings are precautions for handling stronger radioactivity.

① To minimize radiation exposure, the following points should be considered.
Place a shield between the radiation source and the human body
Keep the long distance between the radiation source and the human body
Reduce the time of exposure to radiation
These are called the three principles of radiation protection.

② The blood-forming tissues, gonads, and lens of the eye are the organs of the body most vulnerable to the effects of radiation. Do not put your eyes close to the radiation source to look into.

4. Handling of Cryogens (Dry Ice and Liquid Nitrogen)

Chemical Agents Used in the Experiment

Cryogens Used in Experiments

Cryogens are materials used to achieve low temperatures necessary for experiments.

Their temperatures are low and their form while in use may be different from that at room temperature. Accordingly, the physical and chemical properties of the materials must be fully understood and care must be needed to handle them. In the experiment theme "Specific heat of solids" and "Physical property – experiment using liquid nitrogen," a mixture of ice and water (at 0 ℃) and liquid nitrogen (−196 ℃) are used. While precautions on an everyday level, such as avoidance of long-time contact with skin to prevent frostbite, are sufficient for handling the mixture of ice and water, the handling of liquid nitrogen and its hazards are described on the following pages.

Handling of liquid nitrogen

Precautions in Handling it

Liquid nitrogen is a colorless, tasteless, odorless, low-temperature liquefied gas, and its temperature under atmospheric pressure is −196℃, which is its boiling point. The density of liquid nitrogen is 0.81 g/cm3, and when vaporized it becomes 1.25 x 10-3 g/cm3, so 10 mL of liquid nitrogen will have a volume of about 6.5 L when vaporized. Therefore, attention is required because there are risks of oxygen deprivation bursting the sealed container. To prevent oxygen deprivation, ventilate the room sufficiently, and be sure to check the decrease in oxygen concentration with an oxygen analyzer. When pouring liquid nitrogen into a container at room temperature (the act of pouring is performed by the teaching assistant (TA) or instructor in charge), the liquid nitrogen may vaporize explosively and fly out, so hands and faces must be kept away. **Be aware that touching liquid nitrogen or cooling equipment with bare hands can cause severe frostbite.**

Handling of Liquid Nitrogen in the Experiment Subject of "Low-temperature Properties of Materials"

Liquid nitrogen is stored in a Dewar, which is exclusively designed for its storage, in the laboratory. All liquid nitrogen containers are handled by only the TAs or instructors in charge, so do not touch them. When liquid nitrogen is needed for pouring into or replenishing each experimental container, please ask your TA or instructor for transferring or refilling of the liquid nitrogen into the container required for each experiment. Never add liquid nitrogen to the aforementioned container yourself.

Prevention of Suffocation Accidents

Oxygen Deprivation due to Vaporization of Cryogens

When liquid nitrogen vaporizes and is released into the air in large quantities, it causes the oxygen concentration to drop and suffocate. The oxygen concentration in the air is 21%, but the "safe limit" is 18%, and below this level is called "oxygen deprivation," in which oxygen deprivation symptoms appear. When a person suffers severe oxygen deprivation, he or she is unable to leave the room or open a window on own. If the oxygen level drops below 6%, it causes death. In general, a person who collapses due to oxygen deprivation will not be able to recover until first aid is administered within 3 to 6 minutes after the accident. The table below shows the approximate effects of a decrease in oxygen concentration on the human body.

oxygen concentration (%)	Symptoms
16～12	Increased in pulse and respiratory rates, poor concentration, and headache
14～9	Decreased judgment, unstable mental status, memory loss, increased temperature, cyanosis Increased body temperature, cyanosis
10～6	Unconsciousness, central nervous system disorder, convulsions, and cyanosis
Continuance of 10 ～ 6 or lower level	Coma →bradypnea → respiratory arrest → cardiac arrest in 6 to 8 minutes

One of the reported cases of a fatal suffocation accident was a case in which a large amount of liquid nitrogen was spilled out in a closed room. Because it is very dangerous, leftover liquid nitrogen should not be used for any purpose other than experiments. Thoroughly ventilate the room while using the refrigerant, and use an oxygen analyzer to check whether the oxygen concentration in the room is decreasing.

Handling of Leftover Liquid Nitrogen

Any leftover liquid nitrogen during the experiment should be allowed to evaporate into the air naturally outdoors, and should never be poured into containers such as plastic bottles. Because it can cause rupture, frostbite, or other accidents.

5. Handling of Lasers

The Hazards Level of Lasers and Lasers Used in Experiments

Classification of Lasers by Hazards Level

Laser light is a phase-aligned, highly directional light with a higher energy density than light from ordinary light sources. Therefore, high-power lasers not only direct light but also reflected and scattered light may cause blindness and burn. The table below classifies lasers according to their hazard level. For example, a red laser pointer often used, is classified as Class 2. Even a Class 2 laser can cause eye damage if irradiated to the eyes for a long period, laser light must not be looked at directly. The higher the class has the higher output and is more dangerous. When using lasers of Class 3 or higher, protective goggles must be worn.

class	Overview of Hazard Assessment
I I M	Essentially safe or made safe by technical design. Almost non-hazardous under normal operating conditions. Maybe hazardous when observed or disassembled in the beam by optical means such as lenses.
2 2M	The output of I mW or less. Although not essentially safe, in the case of this class of laser light, the eye will be usually protected with the eye's aversion reaction (blinking) even if it accidentally enters into the eyes. Observation with a lens or other optical means within the beam or prolonged exposure maybe dangerous.
3R	In principle, the output of 5 mW or less. The observation in the beam is potentially dangerous. If the beam is focused using a lens or other means and entered into the eyes, it may cause damage.
3B	The output of 0.5 W or less. Direct or specular reflected light should never be observed in the beam, as it is always dangerous and causes damage. Irradiation of the skin should also be avoided as much as possible.
4	High-power lasers exceeding 0.5 W are dangerous not only in terms of direct light and specular reflection but also in terms of diffuse reflection. It is dangerous not only to the eyes but also to the skin and may cause fires.

Laser to be Used

In the experimental theme "Polarization", semiconductor lasers (wavelength: 635 nm, output power: I mW or less, equivalent to Class 2) are used.

Precautions for Handling Lasers

Attachment, Removal, and Adjustment of a Laser

To prevent direct or multiple reflected laser light from entering the eyes of the experimenter or yourself, the laser is turned off and no light is emitted when always mount or dismount the laser on the optical bench. Adjust the optical system as much as possible while the light is not emitted, and then turn on the output after terminating it securely with a beam block, etc..

Eye Height and Eye Angle

Do not place your eye at the height of the optical path plane created by the direct or reflected light of the laser. When checking the beam shape or adjusting the optical system, shine the laser beam on white paper, etc. and observe the scattered light from a suitable distant position at some angle from the optical path plane. Never look directly into the light or reflected light.

Jewelry and Accessories Worn, Especially Worn on the Hands

When adjusting optical systems with laser beams emitted, laser beams may hit the glass surface of necklaces and wristwatches, or its belt parts, rings, and other wearing jewelry, and the reflected beams may fly in unexpected directions and enter your own eyes or the eyes of other experimenters. Remove these items from yourself when making an adjustment.

Eye Damage due to a Laser

Laser Wavelengths and Eye Damage

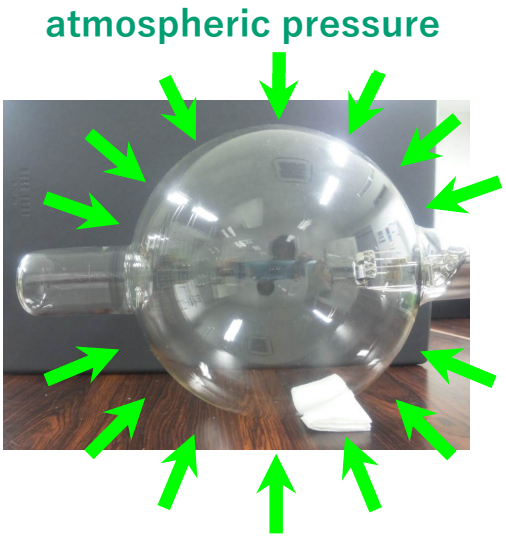
Laser beams with visible light (400 nm to 780 nm) and some infrared light (780 nm to 1,400 nm) are focused on the retina by the eye's optical system (cornea and lens) and have an energy density that is approximately 100 times greater, destroying the retina and causing visual impairment. Destroyed retinal cells do not regenerate. Laser beams with ultraviolet light (200 nm to 400 nm) and some infrared light (from 1,400 nm) are absorbed by the cornea, lens, and other tissues, causing corneal burns and cataracts with vision loss. Ultraviolet and infrared light is more intense than they appear, so care must be needed.

6. Precautions in Handling Various Types of Experimental Equipment

Glass Equipment

Vacuum Glass Equipment

Some experimental themes use glass vessels whose interior is in a near-vacuum state such as measurement tubes for specific charges of electrons. Note that these glass devices are constantly under 1 atmospheric pressure (i.e., approximately 1 kg of force per cm2) from the outside. In such equipment, if a part of it breaks, the entire of it is destroyed at once, which is extremely dangerous. Therefore, care must be needed to avoid shocks to vacuum glass equipment and to prevent any sharp object such as pens and rulers from touching it.



Thermometers and Glass Containers

Ordinary glassware such as thermometers and glass containers can also cause serious and unexpected injuries unless it is handled with care.

3 Laboratory in Chemistry

Aims of “Laboratory in Chemistry” and Safety Precautions

The aim of the course “Laboratory in Chemistry” is to enhance your interests and deepen your understanding of chemistry by performing experiments and considering the experimental results well. Since chemistry is a discipline that deals with the properties and changes of substances, you will handle some substances handled in the course that are highly reactive. These substances are often more dangerous than ordinary ones around us.

For safe experiments, it is important to assess the occurrence and severity of the risks and, to take precautionary measures for preventing accidents and minimalizing the risks. Experiments in “Laboratory in Chemistry” use small amounts of chemicals and are relatively safe. Even so, there are always risks of accidents especially when you handle chemicals in the wrong way. Therefore, you must pay maximum attention during experiments. Since the biggest causes of accidents are lacking knowledge, ignorance and carelessness, please read and understand the following safety guidelines carefully before starting experiments.

1. Introduction

Proper Lab Clothing

Safety Goggles

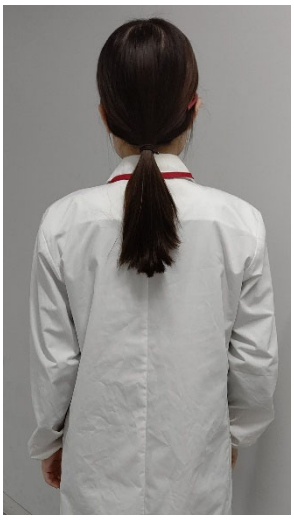
Since the chemical exposure to eyes causes a severe health problem, safety goggles are required to be worn in the chemical lab. Protection of normal eye-wear is insufficient for lab use. Safety goggles should be worn over standard eye-wear. Contact lenses hold chemicals and cause further damage. For this reason, eye-wear is strongly recommended to be worn with safety goggles rather than contact lenses.

Laboratory Clothing

A clean lab coat should be worn when performing experiments. Wear a dedicated lab coat over clothes that are comfortable to work in. Avoid wearing stockings or exposing clothes (such as skirts or shorts) as they may cause chemical injuries in case of spills of chemicals adhesion.

Laboratory Gloves

Latex gloves should be used for experiments. If you are allergic to the material and find it difficult to wear the gloves, please ask your instructor.



Shoes

Wear shoes that are comfortable and cover the entire foot. Unstable shoes (high-heeled shoes and slippers etc.) are prohibited. Partly opened shoes (sandals and pumps etc.) are also prohibited. Slippery wet shoes should be dried when entering the laboratory (shoe matt).

Hair

Long hair can come into contact to chemicals or a hot plate. Long hair is also a hazard around rotating equipment. Long hair should be tied back with a hairband, etc.

General Precautions in a Laboratory

Entering the Laboratory

① Wear a lab coat and protective goggles before entering the lab, and keep them on until leaving the lab.
② Check emergency exits, evacuation routes, fire extinguishers, emergency showers, and eye washers. Also, remove any obstacles on the aisle.
③ Check the instructions for the day (written on a whiteboard or given orally) and make sure you understand them. If you have any questions, ask your instructor or teaching assistants (TAs).
④ Check apparatus and chemicals. Prepare in advance if something is missing.

During the Experiment

① Keep the laboratory clean and organized.
② Do not leave any items on the floor or near emergency exits, fire extinguishers, or emergency showers or keep standing near them, as it may cause accidents or hinder evacuation. If water or chemicals are spilled on the floor, wipe them up immediately.
③ Refrain from talking privately or walking around the room unnecessarily.
④ Handle chemicals with utmost cares. For handling of chemicals, refer to the section "2. Handling of Chemicals and Poisonous Substances."
⑤ Waste (chemicals, glasses, papers, etc.) should be separated and disposed of in designated waste containers.
⑥ Follow the precautions for handling machines and instruments. For some equipment that requires special attention, refer to the section "3. Handling of experimental equipment. "
⑦ Always follow the instructions for experiments, such as "conduct in a fume hood". In principle, chemicals placed in a fume hood should be handled in the hood.

After the Experiment

① Wash hands thoroughly with a soap.
② Wash used lab coats, towels, etc. promptly.
③ If you notice any accidents or something unusual, record them as much detailed as possible on your lab notebook and report them to your instructor or TAs.
④ It is forbidden to take out chemicals, instruments, equipment, etc. that are installed in a laboratory.

2. Handling of Chemicals and Toxic Substances

In chemistry experiments, various hazardous chemicals may be used, such as harmful substances (e.g., poisoning or injuring), flammables, allergens, carcinogens and environmental pollutants. When conducting such experiments, utmost care needs to be taken to protect your health. You should also bear in mind that organic solvents such as alcohol and acetone are highly flammable and can catch fire easily if they come close to a heat source or an electrical spark. Chemicals must also be disposed properly according to the rules, otherwise they will have a serious impact on the environment. Thus, to handle chemicals safely, we must know their properties first and follow the rules. Before handling chemicals, read the contents of this section carefully and understand the risks and proper handling of chemicals.

Handling of Chemicals

Handling of Chemicals

① Do not take out a larger amount of chemicals than necessary for the experiment.
② Do not bring your face close to chemicals to smell or swallow them.
③ Point the opening of a test tube or a casserole away from you or any other persons during heating or stirring a solution, as the contents may spill.
④ Follow the text procedures unless you get permission for a modified procedure from the instructor.
⑤ Close the lids of chemical bottles and pipettes to the original positions immediately after use.
⑥ Organic solvents dissolve plastics and acid solutions corrode metals and electronic devices. Such chemicals should be handled carefully as not to expose them to skin or stationery and equipment.

Heating of Chemicals

Flammable organic solvents should be used away from hot plates because they will ignite. Hot plates should always be cleaned from chemicals spills, even if not flammable, as they may cause toxic gases by thermal decomposition.

Spilt Chemicals

When a flammable liquid is spilt, turn off the heat sources first. A small amount of liquid should be immediately wiped up with tissue paper or a dust cloth. Small amounts of solids should be swept up with a small broom. The cloths used to wipe off chemicals should be handled with laboratory gloves provided and be disposed of in designated boxes. Refer to “Waste from Laboratories” on p.2 in “Common issue” If you spill a large amount of chemical that cannot be wiped up with a cloth, immediately ask for instructions from the instructor.

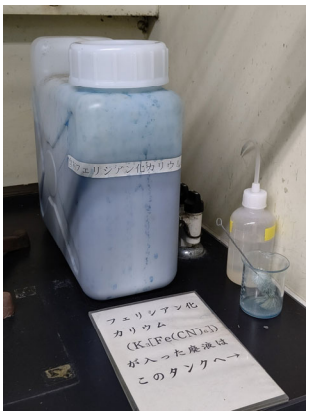
Disposal of Chemicals

Dispose of used chemicals in the following manner.

Disposal of Liquid Waste

At Nagoya University, liquid waste of experiments must be properly sorted, collected, and disposed of. Liquid waste includes the solutions used in the experiment and the first and second rinse of the apparatus and they should be collected and disposed of as follows.

When a plastic beaker for liquid waste is provided on a bench, collect the liquid waste in it during the experiment and dispose of it in a plastic container (photo below) after the experiment. After the disposal of a solution, glassware should be rinsed with a small amount of deionized water twice, and properly dispose of the rinsing solution is required. Plastic containers for liquid wastes are in each laboratory and are designated for a specific solution (organic, heavy metal, cyanide, etc.). Liquid waste should be disposed of properly according to the instructions announced in each lab. The maximum filling level of the container is 80 % of the capacity.



【Flowchart for Separation of Liquid Lab Waste】 (On-campus only)

https://www.esmc.nagoya-u.ac.jp/limit/eng/61_Laboratory_waste_treatment/Liquid_Waste_20200608.pdf

Disposal of Solid Chemicals

Small quantities of solid chemicals can be disposed of in a "Non-Infectious Industrial Waste" box according to the instruction of instructors. If you need to dispose of a large amount of solid chemical, ask the instructor for instructions. Compounds obtained by synthesis should be wrapped in weighing paper and submitted to the designated plastic tray in the laboratory.

Risk Assessment of Hazardous Chemicals

To prevent accidents, it is necessary to evaluate the chemical hazards (risk assessment) and to understand the potential health or environmental effect of a chemical. Information on chemical hazards can be easily obtained from the labels of chemical containers or from documents issued by chemical producers. This section introduces the SDS and GHS, which are often used to identify the chemical hazards.

Risk Assessment

Nagoya University requires that a risk assessment must be conducted for all chemicals which you are going to use. A check sheet, which is available from the URL link below, will help you to summarize the chemical hazards of each chemical reagent and to confirm corresponding safety measures.

Chemical Risk Assessment Check Sheet

https://www.esmc.nagoya-u.ac.jp/risk/Check_sheet_for_chemical_substance_risk_assessment.pdf

SDS (Safety Data Sheet)

An SDS is a document with information on the chemical hazards, which can be obtained from chemical producers. Information on chemicals used in the experiments can be found by searching the internet with keywords like "The name of the chemical, SDS". An SDS includes information such as the properties, hazards, protective measures, and precautions for handling of chemicals in the following 16 sections. You are expected to understand in advance the hazards and handling precautions of the chemicals that will be used in the experiment.

1. Identification
2. Hazards identification
3. Composition/Information on Ingredients
4. First Aid Measures
5. Firefighting Measures
6. Accidental Release Measures
7. Handling and Storage
8. Exposure Controls/Personal Protection
9. Physical and Chemical Properties
10. Stability and Reactivity
11. Toxicological Information
12. Ecological Information
13. Disposal Considerations
14. Transport Information
15. Regulatory Information
16. Other Information

GHS (Globally Harmonized System of Classification and Labelling of Chemicals)

GHS is a system of the classification and labeling of chemical hazards and toxicity that is adopted by countries around the world. There are nine pictograms under GHS that visually convey hazards. These pictograms are used not only for chemicals, but also for labels of daily items such as bleach. By knowing the pictograms and their meanings, they will provide clear warnings and the hazardous properties of chemicals.

【Flame】
Flammables, Self-reactives, Pyrophorics, Self-Heating, Emits Flammable Gas, Organic Peroxides

【Flame over circle】
Oxidizers

【Exploding Bomb】
Explosives, Self-Reactives, Organic Peroxides

【Corrosion】
Corrosive to Metals, Skin Corrosion/Burns, Eye Damage

【Gas Cylinder】
Gases Under Pressure

【Skull and Crossbones】
Acute Toxicity (Fatal or toxic)

【Exclamation Mark】
Irritant (skin and eye), Skin Sensitizer, Acute toxicity (harmful), Narcotic Effect, Respiratory Tract Irritant, Hazardous to Ozone Layer

【Environment】
Aquatic Toxicity

【Health Hazard】
Mutagenicity, Carcinogen, Reproductive Toxicity, Respiratory Sensitizer, Target Organ Toxicity, Aspiration Toxicity

About the GHS (UNECE) https://unece.org/about-ghs

Handling of Poisonous and Deleterious Substances

“Poisonous and Deleterious Substances Control Act (in Japan)” was implemented to control harmful substances from the viewpoint of health and hygiene. In order to prevent accidents and crimes associated with harmful substances, the law stipulates the types of poisonous（毒物）and deleterious（劇物）substances, supplemental records of purchase, use and disposal, and secure storage in a locked cabinet. The handling of poisonous and deleterious substances at Nagoya University is regulated by the “Nagoya University Guidelines for the Management of Poisonous and Deleterious Substances” and the “Poison Handling Guidelines for Nagoya University Liberal Arts and Sciences Laboratory Work” (see links on p.65) “Poisonous and deleterious substances” can only be used under the supervision of responsible instructors in the designated laboratories. Students who take the Liberal Arts and Sciences laboratory courses are allowed to conduct experiments handling the minimum necessary amount of poisonous and deleterious substances under the guidance and supervision of authorized instructors and are obliged to comply with the regulations and instructions.

Poisonous and Deleterious Substances Used in Class

The poisonous and deleterious substances used in the class are listed in the textbook or will be introduced in the laboratory. Students are required to follow the instructions for each chemical given in the textbook and explained by the instructor. It is strictly prohibited to use more amount than necessary, to take chemicals out of the laboratory, or to allow outsiders to enter the laboratory (violation of regulations and laws). The laboratory is locked after the course. When you find a loss of chemicals or any violations such as taking chemicals out of the room, let the instructor know immediately.

The Difference Between Poisonous and Deleterious Substances

Poisonous (毒物) and deleterious (劇物) substances in Japanese law are judged on the basis of their poisoning potential to health from the knowledge listed below. Poisonous and deleterious substances differ in their judgment criteria, and the criteria of poisonous substances is designated as higher toxicity than deleterious substances. In addition, since chemicals which are not designated as poisons or deleterious substances by law may have similar toxicity, it is necessary to be careful when handling any chemicals.

① Animal testing →
   a) Acute toxicity (LD50 values by oral, dermal, and inhalation)
   b) Corrosiveness to skin,
   c) Serious damage to mucous membranes such as eyes
② Human exposure → Toxicity examined and judged from accident cases, etc.
③ Others → Toxicity/irritation based on the knowledge of physicochemical properties such as reactivity, *in vitro* tests, etc.

3. Handling of Experimental Equipment

Read the textbook and the instructions carefully to fully understand how to handle the equipment and devices. The following is a list of cases of risks and accidents.

Heating

Unless otherwise specified, the chemicals are heated by a water bath (a water-filled beaker heated on a hot plate). The temperature of the hot plate surface is higher than 600 °C when heated. Hot plate used in labs present potentials of risks such as burns and fires. Pay attention even after the heater is off because it remains hot for a while, and it is hard to see the surface temperature.

Centrifuge

When you operate the centrifuge, test tubes in a rotor should always be balanced. Put 2 (or 4) test tubes with roughly the same weight/amount of solution in them. Never open the lid of the centrifuge during operation.

High Voltage Power Supply

High voltages are applied to a hydrogen discharge lamps and sodium-vapor lamps. Be careful not to touch the naked electrodes to avoid electric shock.

Pipette

Never point the open end of a pipette toward yourself or others. When you take a solution in a pipette, pipette out it to a test tube or a beaker immediately. Do not keep a solution in a pipette or move around the lab with a solution in a pipette. A narrow pipette such as a hole pipette or a Pasteur pipette is fragile and should be handled with care.

Broken Glassware

To prevent and minimize the broken glass injury, broken glass should not be handled with hands without protective equipment. When glassware is broken, inform students around you not to approach and ask the instructor for cleaning. Since small pieces glass are hard to find especially when they are wet, use dustpan and brush for cleaning.

4. In Case of an Accident (Laboratory in Chemistry)

Any accident in the lab should be reported to the instructor regard less its degree of injury. Refer to the specific instructions shown below as well as in p.19" First Aid and Life-saving Treatment" .

In Case of Skin Contact

In case of a small amount of an acid, alkali, or metal salt aqueous solution or organic solvent such as acetone methanol, rinse the area thoroughly with water. Other organic compounds should be immediately wiped off with tissue paper and contact your instructor for the instructions. If a large amount of a chemical (especially corrosives) is on your body, remove the clothing on which the chemical has adhered and use an emergency shower to wash affected area (see p. 51).

If the chemical causes skin irritation during experiment, inform the instructor of the type of chemical and receive treatment from a surgeon or dermatologist.

If you notice any skin irritation, blisters, or other abnormalities after returning home, have medical examination immediately and report it to your instructor.

In Case of Eye Contact

Immediately rinse eyes thoroughly with plenty of tap water (see p. 50). Ask students nearby or the instructor for help. Even if the symptoms are mild, be sure to see an ophthalmologist.

If Swallowed

Immediately inform the instructor or ask students nearby to do so. Clarify the type and amount of the chemical. Swallow of any chemicals other than dilute acids-alkalis (0.01M) requires medical treatment.

If Inhaled

If you feel nausea, headache, or dizziness after inhaling chemical vapors, go out of the room immediately and breathe fresh air. Ask someone around you to notify the instructor and seek instructions.

If Injured

If any chemicals are on the wound, wash them off with a large amount of water first. Depending on the size of the wound and the degree of bleeding, have medical treatment at the infirmary or by a surgeon.

In Case of Skin Burn

Cool the burn under running water regardless of the degree of the burn. Ask someone around you to notify the instructor.

In Case of Fire

Shout "Fire!" and move away from the fire. Clear away any combustibles near the fire with students around you. The fire extinguishers are equipped in all labs and on the corridor. As the scale of the experiment in the course is small, most fires can be extinguished with fire extinguishers. Those who are not involved in firefighting should take distance from the fire. However, if the flames reach the ceiling, stop firefighting, evacuate the laboratory immediately followed by instructions of the instructor, and activate the fire alarm.

If Clothes Catch Fire

A person nearby is responsible to notify the instructor immediately. Use emergency shower to distinguish the fire. Never try to take off your clothes or roll on the floor to put out the fire.

5. Safety Equipment

Be sure to check the location of safety equipment in the laboratory and familiarize yourself with its use.

Fume Hood (Local Ventilation System)

Fume hoods are installed in the room between the lab 1 and 2. The work area of a fume hood is ventilated to use substances that may produce harmful gases or odors. Experiments which should be performed in it are given in the textbook.

Eye Wash Water Tap

Eye wash water taps are installed in the sink of each laboratory. When chemicals contact the eyes, they should be rinsed with a large amount of water.

Emergency Shower

Emergency showers are installed on the wall of corridor. They can be operated simply by pulling the lever. If your clothes catch fire or a large amount of a chemical contacts your skin, use emergency shower.

4 Laboratory in Biology

The following describes common precautions to bear in mind when conducting experiments. Be sure to understand the experimental procedures, etc., and follow the basic rules of proceeding with the experiment with care to prevent accidents. In Laboratory in Biology, a wide variety of living organisms and instruments are handled. The individual precautions required for each lab theme will be explained in the guidance before the start of the practical training. It is necessary for students to attend the class without delay and fully understand the points to be noted.

1. Introduction

Personal Belongings

Since personal belongings will interfere with experimental operations, place them in the designated area before class starts or in a locker for Liberal Arts and Sciences students, and bring only the minimum necessary items to the laboratory, such as pens, pencils, and lab notebooks.

Eating and Drinking in the Laboratory

Do not eat or drink in the laboratory. If you need to hydrate, keep a beverage in your locker and go drink it if necessary.

White Coat

White coats may be required due to the possibility of skin or clothing contamination from various reagents, pigments, or animal blood. In such cases, an announcement will be given in the guidance including how to obtain them, so please follow it.

2. Handling of Chemicals

Although highly hazardous chemicals such as poisonous or deleterious substances are rarely used in Laboratory in Biology, when using such chemicals, listen carefully to the instructor's instructions and take extra care not to get them on your skin or clothing. In addition, use the chemicals safely by wearing gloves, if necessary. In the event of skin or clothing contamination by reagents, etc., your instructor or teaching assistants (TAs) will provide first aid, so raise your hand immediately to let them know. If a white coat or protective goggles are required, it will be announced in the guidance including how to obtain them. In addition, dispose of the chemicals in an appropriate manner following the instructor's instructions.

3. Handling of Individual Equipment and Instruments Used in Laboratory in Biology

Microscopes

In Laboratory in Biology, each person often uses one microscope individually for observation. Because microscopes are used by several faculties day after day, the utmost care must be taken to prevent breakdowns. If you notice any problems with the microscopes, notify your instructor or TAs immediately. The microscopes are stored in storage boxes in a dedicated locker, and the boxes must be carried to each student's lab testing bench when used. Since the microscopes are quite heavy, care should be taken when taking them out from the locker (especially for those who use the microscopes stored in the upper section), and the bottom of the box containing the microscopes should be held firmly with both hands when carrying them. Do not use the handles on the top of the storage box, as they may come off. Also, since the microscopes are precision instruments, take care to prevent vibration and shock because they are vulnerable to them. Detailed usage instructions will be given at the beginning of the course, so be sure to understand them very well and be careful not to handle the microscopes incorrectly. At the end of the experiment, make sure that no glass slides remain on the microscope, and return it to the locker in the designated method.

Razors

Razors for preparing samples for microscopic observation will be provided at the beginning of the class and collected at the end. Razors must be placed in the designated container when collected. Razor blades are extremely sharp, so accidents such as cutting fingers can easily occur. Use razors only when necessary, and always keep them visible even when not in use. Handle them with sufficient attention.

Cover Glass and Slide Glass

The cover glass used for microscopic observation is an extremely thin glass plate, 18 mm square and 0.15 mm thick, and is easily broken. Broken pieces of glass can easily injure fingers and other parts of the body, and are extremely dangerous if they enter the body. Therefore, it is necessary to handle it with sufficient attention. Since cover glasses and glass slides are disposable in Laboratory in Biology, be sure to dispose of them in the designated containers after use, rather than leaving them on the bench or the like.

Tweezers and Dissection Needles

Tweezers and dissection needles used in Laboratory in Biology have thin, pointed tips, so be careful not to bend them. Care should also be taken to prevent stabbing accidents.

Scissors

Scissors used for dissection will be provided by the university. As with microscopes, they will be used by several faculties in common, so be careful when handling them. Care must also be taken to prevent injury. If an accident occur, notify your instructor or TAs immediately.

Gloves

For safety reasons, plastic gloves should be worn during the dissection practice in Laboratory in Biology, even though animals uninfected with pathogenic microorganisms should be used. The use of gloves will be explained in detail during the practice. When disposing of gloves at the end of the practice, separate them from general waste and dispose of them in designated containers (for biohazardous waste). Never mix them with general waste.

Paper, etc.

Paper used to wipe laboratory equipment and laboratory benches should not be disposed of as general combustible waste, but in containers designated as non-infectious industrial waste. Paper on which a part of biological materials or bodily fluids have adhered should be disposed of in containers designated as infectious industrial waste.

Biohazard

A wide variety of biological materials are used in Laboratory in Biology. Although we take care not to use materials that could cause biohazards such as bacterial or viral infections, there is no such thing as sterile biological materials. There is no need to be overly afraid, but care must be taken to wash hands after each experiment. As mentioned earlier, eating, drinking, and smoking are prohibited in the laboratories to prevent the ingestion of infectious microorganisms or materials contaminated with hazardous reagents. The best way to prevent accidents is to listen carefully to the instructor's warnings at the beginning of class and to follow them.

4. Precautions for Field Practice

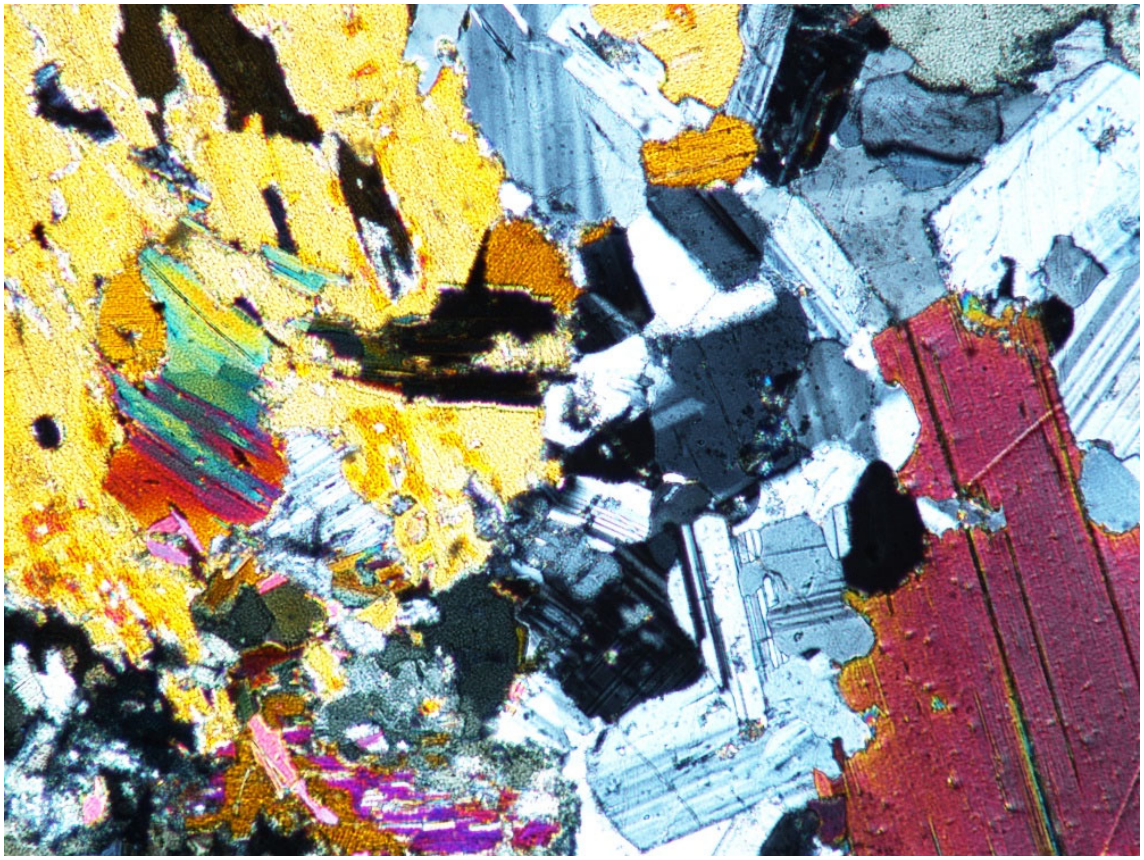
Clothes

Since it is held on the Higashiyama Campus, it is considered that there is no particularly big danger. However, it is necessary to dress appropriately for outdoor activities (clothes easy to move, shoes easy to walk, etc.) and to prepare rain gear in case of rain. In the summer, measures against heat stroke are also necessary. Only carry items necessary for the practice, and keep any extra belongings in a designated area or locker.

Rash and Insect Bites

It is possible to get a rash from poison ivy or to encounter wasps, etc., so you need to be careful. If you notice any danger, tell your instructor or TAs immediately. And if an accident occurs, cooperate with them to deal with it.

5 Laboratory in Earth Science



In addition to indoor experiments, outdoor practices are conducted in “Laboratory in Earth Science”. In order to conduct indoor and outdoor experiments safely, please pay attention to the following points.

1. Introduction

Indoor experiments are mainly observations using naked eyes or microscopes and do not involve any particularly hazardous works. However, the following points should be noted.

Preparation for the Experiment

Read the textbook in advance to understand the contents and procedures of the experiment. Also, be sure to follow the instructions given by your instructor. This prevents most accidents caused by carelessness.

Clothing for Experiments

It is not specified in particular. Wear what is suitable for each experiment. Depending on the content of the practice, clothes might get dirty by rocks and minerals, so wearing a white coat is recommended.

Organizing the Laboratory

On the laboratory desk, place only the items necessary for the experiment, such as laboratory equipment and writing instruments, in a place where they will not fall on the floor. Personal belongings should be put in a place designated by your instructor. After the experiment, clean the desk and the floor.

2. Precautions for Field Practice

What is Field Practice?

The field practice conducted in Laboratory in Earth Science is a field learning in which students visit where rocks appear on the earth's surface(outcrops) and observe the production of various types of rocks and strata, as well as the minerals and fossils that make them up. Most of the locations where the field practice for Laboratory in Earth Science are conducted are in hilly or low mountainous areas near Nagoya. Outcrops are located along roads, cliffs in developed areas, beaches, and river banks.

Clothing for Field Practice

In order to conduct outdoor practice safely, first of all, it is necessary to pay attention to the clothes when participating. Clothing should be of sturdy fabric and suitable for exercise. Choose clothing with less skin exposure for both the top and bottom. Footwear should be suitable for use on rough road (no heels or sandals). A hat should be worn to protect your head from the sun. Put personal belongings in a backpack or daypack so that both hands are available for work. Keeping both hands free is effective in preventing danger and reducing injury.

3. Dangers in Field Practice

When practicing outdoors, you may encounter a variety of dangers. Although the probability of actually encountering these dangers is not very high, it is important to know what kind of danger exists. Dangers encountered during field practice can be divided into those that are specific to Laboratory in Earth Science practice and those that are related to field activities in general.

Dangers Specific to Laboratory in Earth Science Practice

Accidents Caused by Falling Rocks from Cliffs and Other Outcrops

Rockfalls can occur without warning. It is difficult to escape from falling rocks after they occur. Therefore, it is important to stay away from cliffs where falling rocks are likely to occur. The likelihood of a rockfall depends on the shape of the cliff, the type of rock that makes up the cliff, and the degree of weathering of the rock. For example, a cliff with an overhang at the top, a cliff with weathered rocks that are in tatters, or a cliff with many rocks lying at the bottom of the cliff (a cliff that has had many rockfalls) should be considered dangerous.

Accidents Due to Falls and Tumbles on Outcrops with Poor Footholds

When working around outcrops, different level of care should be taken than when walking on a normal road. Helmets should be worn when working around outcrops to reduce damage in the event of accidents such as falling rocks or falls.

Loose Rocks

A stone that is lying in an unstable state. If you put your foot on it, you may lose your body balance and fall over.

Riverbanks and Seashores

Wet stones are slippery. Especially those with moss or algae on them are, so extreme caution is required when walking in such areas.

Slopes and Cliffs

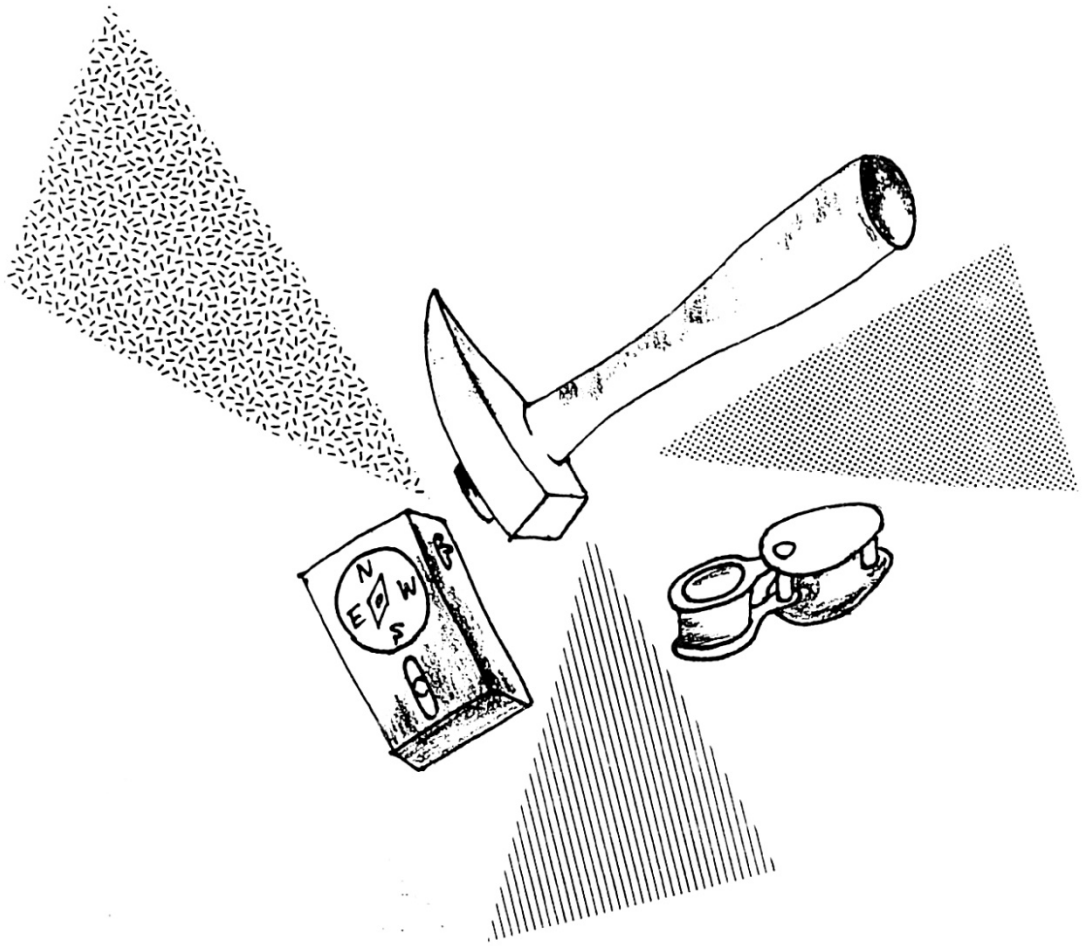
It is not advisable to climb up to see the rocks above you. The danger of slipping and falling is more likely to occur to inexperienced people.

Use of Hammers

A hammer is used to break rocks and collect and observe rocks, minerals, and fossils, etc. Care should be taken to prevent bruising on the body from the hammer and injury from rock fragments scattered when the rock is broken (especially dangerous if they hit your eyes). You must take care not only of himself but also of those around you. When using the hammer, gloves (work gloves) should be worn to prevent cutting hands with broken rocks, and protective goggles should be worn to protect your eyes.

Damage to Hammer

While using a hammer, damage may occur such as the handle breaking off, the hammer tip slipping off the handle (it is not abnormal for the hammer to come loose toward the hand), or cracking (the hammer face cracking and chipping). If such damage is found, notify your instructor in charge immediately. It is dangerous to use the hammer as it is.



Dangers Present in Outdoor Activities in General

Traffic Accident

Be aware of traffic accidents during practical training. Depending on the course of the field training, sometimes you may walk on busy roads with no sidewalks. Sometimes you may have to walk on busy roads without sidewalks.

Sudden Illness

When participating in a field practice, students should prepare their physical condition for the day. However, even when you are supposed to be in perfect condition, you may suddenly feel unwell during the practice. For example, sunstroke, heatstroke, and sudden abdominal pain could occur. If you feel something wrong with your condition, do not overdo it and notify it immediately to your instructor.

Bad Weather

In case of heavy rain, strong winds, lightning, swollen rivers, high waves, etc., the schedule of a practice may be changed or cancelled. Students should follow the instructions of the instructor carefully.

Dangerous Creatures

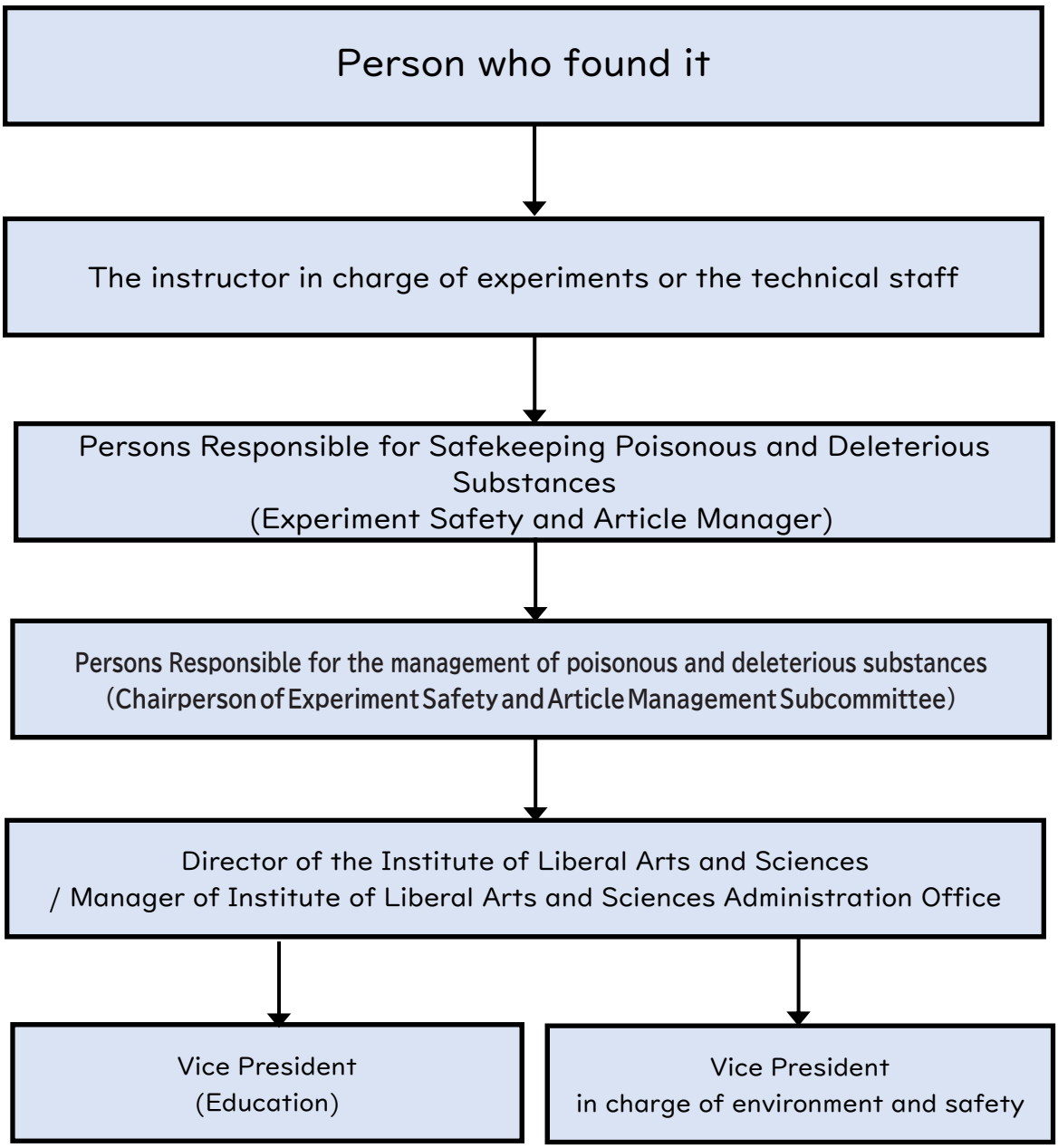
Although there are many species of organisms that can harm us, the followings are some of those that we may encounter in the Nagoya area. The degree of danger varies from mild dermatitis to life-threatening. For information on how to recognize these creatures, where they live, and what to do about them, refer to "Dangerous Creatures in the Outdoors (*Yagaini-okeru Kiken-na Seibutsu,* ISBN:9784582540123)" published by Heibonsha, edited by the Nature Conservation Society of Japan (NACS-J).

Wild/stray dogs (*yaken*), pit vipers (*mamushi*), centipedes (*mukade*), certain spiders (*kumo*), hornets (*suzume-bachi*) and other bees (black ones are aggressive, so wearing a hat to cover the hair on your head will have some effect), moths such as poisonous moths (*dokuga*), land leeches (*yamabiru*), horseflies (*abu*), blackflies (*buyu*), mites (*dani*), lacquer(*urushi*) plants, etc.

＊ There are many other plants and animals that are dangerous to eat, but they are omitted here.

Appendix at the End of the Book (For Instructors)

【Contact flow regarding an accident involving a poisonous and deleterious substance, theft, and losing】



【The list of the Link to Some Guidelines, Rules, Conditions, etc.】

- Guideline for Personal Protective Equipment on Experiments（Internal Page）
  https://www.esmc.nagoya-u.ac.jp/limit/other/hogogu/pdf/Guidelines_for_PPE_on_experiments.pdf

- Arrangements on the Handling of Accidents (injury) of Students that have Occurred During the Classes of Liberal Arts and Sciences Courses
  https://office.ilas.nagoya-u.ac.jp/files/kyoka/safety/safety_accident_.201505-e.pdf

- Nagoya University Guidelines for the Management of Poisonous and Deleterious Substances (Internal Page / Japanese Only)
  名古屋大学毒劇物管理要項
  https://www.esmc.nagoya-u.ac.jp/limit/nusaftylaws/kagaku/nagoya_unv_dokugeki.pdf

- Nagoya University Rules on the Safety Management of Chemical Substances, etc. (Japanese Only)
  名古屋大学化学物質等安全管理規程
  https://education.joureikun.jp/thers_ac/act/frame/frame110000232.htm

- Handling Poisonous and Deleterious Substances Guidelines in Nagoya University Liberal Arts and Sciences Laboratory Work
  https://office.ilas.nagoya-u.ac.jp/files/kyoka/safety/safety_toxic_201903-e.pdf

The source of references

The procedure of cardiopulmonary resuscitation (CPR) when you find the person falling down: The web page from the Tokyo Fire Department

For Liberal Arts and Sciences Laboratory Work
A Guide to Safety
－ To ensure the safety of the experiment－
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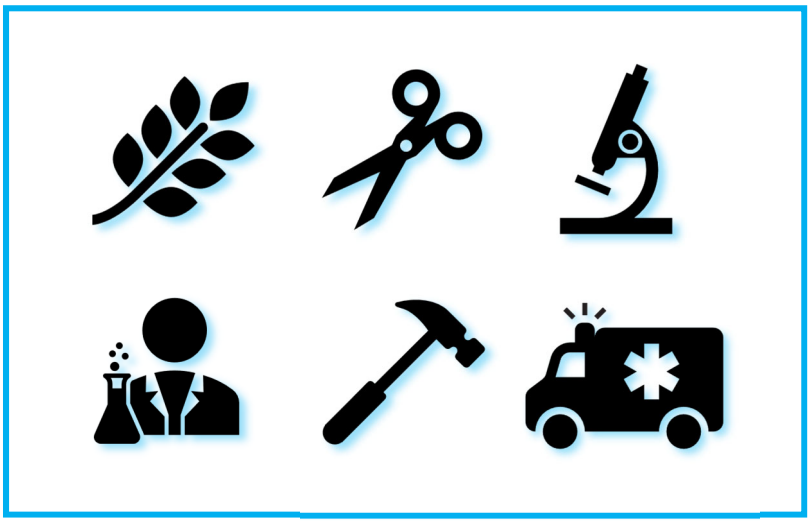

For Liberal Arts and Sciences Laboratory Work

A Guide to Safety 2022-2023